# SUMMARY REPORT •F•Y•1972

# UTILIZATION RESEARCH and DEVELOPMENT

U.S. DEPARTMENT OF AGRICULTURE
Agricultural Research Service
Washington, D.C.
May 1973

SUMMARY REPORT OF

# Utilization Research and Development

## PREFACE

This report is prepared in response to a request by the Committee on Appropriations in its report to the Senate on the Agricultural and Farm Credit Administration Appropriation Bill, 1960 (Report No. 330), for an annual summary statement on utilization research and development activities conducted by the Agricultural Research Service. Previous reports have been submitted for fiscal years 1959 through 1971.

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UNITED STATES DEPARTMENT OF AGRICULTURE
Agricultural Research Service

# SUMMARY REPORT OF UTILIZATION RESEARCH AND DEVELOPMENT

Fiscal Year 1972

## I AIM AND OPERATION OF UTILIZATION RESEARCH

Utilization research, aimed at expansion of agricultural markets and reduction of processing and distribution costs, can increase farm income, benefit domestic consumers, and contribute to U.S. programs of assistance to developing countries. Such research can help to bring into balance the supply of, and demand for, farm commodities. In pursuing its objectives, USDA's utilization research and development effort is directed to: (a) devising new food products that are attractive and economical, and fit the distribution requirements in worldwide market channels; (b) improving functional properties of the natural fibers, cotton, wool, and mohair, to better meet consumer needs; (c) developing more economic and more suitable processed feed products needed in the expansion of the poultry, dairy, and livestock industries; and (d) seeking broadened and profitable industrial uses for agricultural materials. Concurrent attention is given to such related functions as expansion of foreign markets for U. S. agricultural products, improved nutritional quality of food products, protection of food products from contamination by toxins and other health hazards, and reduction of pollution caused by agricultural processing wastes.

The Department's utilization research investigations in fiscal year 1972 were conducted primarily in Federal facilities in the United States, consisting of five regional research laboratories (located in New Orleans, La.; Albany, Calif.; Wyndmoor, Pa.; Peoria, Ill.; and Athens, Ga.) and twelve other field locations (in Beltsville, Md.; Washington, D.C.; Waltham, Mass.; Lexington, Ky.; East Grand Forks, Minn.; Olustee and Winter Haven, Fla.; Raleigh, N.C.; Weslaco, Tex.; Pasadena, Calif.; Honolulu, Hawaii; and Puyallup, Wash.). Additional research outside of these laboratories and field locations is conducted through contracts, grants, and memoranda of understanding with State Experiment Stations, universities, private research institutions, and industry. Other supporting research is conducted in foreign research institutions through funds generated by the P. L. 480 program (Agricultural Trade Development and Assistance Act of 1954, 83rd Congress, 2nd Session, as amended). Each of the regional research laboratories is now established as an area under the Agricultural Research Service as reorganized on July 1, 1972.

## II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE

Continuing, positive emphasis is placed on disseminating the results of utilization research to interested segments of the agricultural industry. The following summary illustrates the uses made of various information media in F.Y. 1972:

| | |
|---|---|
| 110 | patents granted |
| 971 | technical papers published |
| 606 | speeches, press releases, and appearances on radio and television |
| 37 | formal conferences with industrial and other organizations |
| 12 | exhibits for the public and technical groups |
| 6,409 | technical visitors to regional laboratory installations |

### (A) Exhibit Materials

The following special exhibits were prepared and shown during F.Y. 1972 to inform the public and technical groups of USDA developments in food, fiber, and industrial products made from agricultural sources:

| Nature of Exhibit | Group Concerned |
|---|---|
| Individual quick blanching (IQB) process | Institute of Food Technologists--Northern California Meeting, Berkeley, Calif. |
| Individual quick blanching (IQB) process | Pacific Northwest Food Processing Association Meeting, Seattle, Wash. |
| Tomato acid-break process | Canners League of California Meeting, San Francisco, Calif. |
| Protein Around the World | Heart of Illinois Fair Peoria, Ill. |
| Kenaf as a new crop | Lakeview Center for Arts and Sciences Peoria, Ill. |
| Technical film "Nylon 1313" | Industrial Seminar Peoria, Ill. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(A) Exhibit Materials (contd.)

| Nature of Exhibit | Group Concerned |
|---|---|
| Discount cottons | 12th Cotton Utilization Research Conference, New Orleans, La. |
| Unlocking food potential in cottonseed | U. S. Cotton Research Station Shafter, Calif. (50th Anniversary) |
| Whey technology, utilization and products | Wissahickon Valley Watershed Association Biannual Conservation Fair, Ft. Washington State Park, Pa. |
| Shearlings, garments, hospital bedpads and role of keds in cockle | Wool Symposium, Lubbock, Tex. held by Sheep Industry Developments, Inc. |
| Explosion puffing film | Film Festival presented by American Association of Agricultural Engineers, Chicago, Ill. |
| Apre's ski leather fashions | Photographed at Pocono ski resort and at French Creek Sheep and Wool Co., French Creek, Pa. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| Lemon Products Technical Committee (7/14/71; 9/22/71; 12/8/71; 3/20/72; 6/12/72) | USDA and Lemon Industry | 86 | Pasadena, Calif. |
| Food Protection Technical Committee of Grocery Manufacturers of America (7/27/71) | USDA | 43 | Berkeley, Calif. |
| Eleventh Technical Alfalfa Conference (7/29-30/71) | USDA and American Dehydrators Assn. | 103 | Berkeley, Calif. |
| Professional Council of Scientists & Engineers Advisory Board to U.S. Civil Service Commission (8/26-27/71) | USDA | 25 | Berkeley, Calif. |
| Annual Citrus Research Conference (12/7/71) | USDA | 85 | Pasadena, Calif. |
| American Bakers Assn. Technical Liaison Committee (2/2-4/72) | USDA and American Bakers Association | 56 | Berkeley, Calif. |
| Technical Committee of the Assn. of Operative Millers (2/3/72) | USDA | 26 | Berkeley, Calif. |
| Hops Research Subcommittee (2/9/72) | USDA & U.S. Brewers Assn. | 26 | Berkeley, Calif. |
| Western Experiment Station Collaborators' Conf. "Food Additives" (3/15-17/72) | USDA and Univ. of Calif. | 67 | Berkeley, Calif. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| California Dry Bean Advisory Board Utilization Research Committee (6/15/72) | USDA | 23 | Berkeley, Calif. |
| NFPA LSO Technical Committee - Technical Subcommittee II (6/7-8/72) | USDA, Natl. Flaxseed Processors Association | 23 | Peoria, Ill. |
| North Central Agricultural Experiment Station Collaborators' Conf. (3/13-14/72) | USDA, North Central Agr. Experiment Station Collaborators | 105 | Peoria, Ill. |
| 18th Annual Joint Conf. of Coop. Soybean and Cottonseed Oil Mills (3/14-17/71) | USDA (ARS and Farmer Coop. Service) | 200 | Fresno, Calif. |
| Soybean Utilization Research Conference (3/18/72) | USDA, Natl. Soybean Processors Association | 18 | Peoria, Ill. |
| Annual Corn Dry Milling Conf., Research Liaison Committee of ACMF (6/14-15/72) | USDA, Amer. Corn Millers' Federation | 64 | Peoria, Ill. |
| League for International Food Education (LIFE) Protein Conference (1/13-14/72) | USDA, LIFE | 30 | Peoria, Ill. |
| Seminar on "Nylon 1313" for industry (6/27/72) | USDA | 25 | Peoria, Ill. |
| Use of Nonwood Fibers in Paper (10/24-27/71) | Technical Assn. of Pulp and Paper Industry (TAPPI) | 70 | Houston, Tex. |

II. MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| 7th National Conference on Wheat Utilization Research (11/3-5/71) | USDA, Great Plains Wheat, Inc. and affiliated state agencies, Kansas State Univ., Millers Natl. Fed., Natl. Assn. of Wheat Growers, Western Wheat Associates, USA, Inc., and affiliated state agencies | 150 | Manhattan, Kans. |
| National Corn Growers Assn. Annual Conf. | Natl. Corn Growers Assn. | 1,300 | Des Moines, Iowa |
| 21st Oilseed Processing Clinic (2/7-8/72) | USDA and Miss. Valley Oilseed Processors Assn., Inc. | 69 | New Orleans, La. |
| 18th Annual Joint Conf. of Cooperative Oil Mills (2/28-3/1/72) | USDA and Farmer Coop. Service | 188 | Fresno, Calif. |
| Conference of Collaborators from Southern Agr. Expt. Stations (3/20-21/72) | USDA and Southern Agric. Expt. Stations | 100 | New Orleans, La. |
| 12th Cotton Utilization Research Conference (5/8-10/72) | USDA | 168 | New Orleans, La. |
| 21st National Potato Utilization (7/29/71) | USDA, United Fresh Fruit & Veg. Assn., No. Dak. St. Univ. | 213 | No. Dak. St. Univ., Fargo, N.D. |
| Northeastern Expt. Station Collaborators (10/26-27/71) | USDA | 122 | Wyndmoor, Pa. |
| Eighth Triennial Maple (10/19-20/71) | USDA, Natl. Maple Syrup Council & Mich. Maple Syrup Producers | 113 | Boyne Falls, Mich. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(B) Formal Conferences with Industrial and Other Organizations (contd.)

| Conference | Sponsors | Attendance | Location |
|---|---|---|---|
| Meat Packers and Processors Seminar (4/11-12/72) | USDA, Pa. Meat Packers, Pa. State Univ., and Rutgers Univ. | 55 | Pa. St. Univ., University Park, Pa. |
| Whey Products (6/14-15/72) | USDA, Whey Products, Inst. | 194 | Chicago, Ill. |
| Research & Development Council of the Evaporated Milk Assn. (10/14/71) | USDA-organized program | 19 | Washington, D.C. |
| Nitrosamine Workshop (6/1/72) | USDA | 25 | Wyndmoor, Pa. |
| Food Science | USDA, Food Science Depts. of Land Grant Colleges in Southeastern States | 25 | RRC, Athens, Ga. |
| Citrus Conference | USDA's Citrus and Subtropical Products Lab., Fla. Citrus Industry | 144 | Winter Haven, Fla. |
| Pecan Conference | USDA, Food and Drug Adm. of HEW | 60 | RRC, Athens, Ga. |
| Peach Conference | Southeastern Peach Workers, Clemson Univ. | 75 | Clemson, S.C. |
| Tobacco and Health | Tobacco and Health Res. Institute of the Univ. of Kentucky | 80 | Lexington, Ky. |
| Interagency Meeting on Poultry Pollution | ARS, ERS, and Ga. Agric. Expt. Station | 50 | RRC, Athens, Ga. |

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities

Studies are being continued to find profitable uses for rice and wheat straws and hulls and other waste materials from farming, in order to reduce pollution caused by burning, dumping and other presently used methods of disposal. These waste materials occur in rural areas, and any industry set up to process them will be beneficial in providing employment in those areas. Grower and processor group contacts are being maintained.

Developed process for conversion of waste turf grass clippings to a high quality xanthophyll source for poultry feed. Two plants are in commercial production and a third is being constructed, all providing employment in rural areas of California, while reducing pollution.

Consultation is continuing, in cooperation with ERS and the Four Corners Commission, on the possibility of processing beans in S.W. Colorado, a largely undeveloped area. A market study has been completed of new products from dry pinto beans, and discussions have been held with representatives of agriculture and industry on the feasibility of establishing a processing plant in the Four Corners' area.

Consultation is continuing with the Apricot Producers Association advising them on improved storage and handling, and demonstrating possible new products such as drum-dried puree, no-sulfur dried apricots and Osmovac apricots.

Conducted research and consulted with agricultural producers and processors on growing and utilizing papayas for processing to use Hawaii acreage formerly devoted to sugarcane, but no longer needed for that crop.

Cooperated with the Washington State Experiment Station and farmers on production of wine grapes that might be well suited to newly available irrigated lands in the Columbia River Basin, and evaluated quality of wines from experimental vineyards.

Consulted with growers and processors on the oversupply and quality deficiencies which have depressed the Washington state mint industry. Continuing analyses on components responsible for flavor variation, in work aimed at restoring a competitive posture to this rural industry.

Continued to aid a California honey cooperative in devising new products means for their production, and improved quality control via guidance in establishing a quality control laboratory.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Participated, with ERS, in the Agribusiness program making contacts for a marketing study of convenience lamb products, a part of their investigation to enhance the sheep industry in the Old West Development Region and the Navajo Indian Tribe.

Consulted with a special committee in the favorable evaluation of a proposal of a minority group in Yakima, Washington, t. build a $2 million mushroom growing and processing plant in that State.

Participated in an ERS survey of consumers to ascertain present use of catfish and the factors that influence its use, as price, availability, appeal of name, etc., to evaluate the potential market for catfish and provide information to guide research programs for this new agricultural industry.

Continuing consultation with a potential new processor of dry bean powders to construct a plant near Hazelton, Idaho, on processing techniques and equipment requirements.

Sixteen paper mills in rural Wisconsin were visited and supplied technical information concerning research on starch graft polymers, cationic flours, and starch xanthates.

Therm Products Company, New Richmond, Wisconsin, was provided information on the flatulent factors in soybeans and on the digestibility of raw soybeans vs. toasted soybeans.

Royal Colony Farm, Mathews County, Virginia, was provided with information on soybean-based foods and their preparation and use.

Mr. George A. Rolfes, Boone, Iowa, was provided with information and procedures for the recovery and handling of soybean oil from filtering clays, with the possibility of building an extraction plant for this purpose.

Farmers Cooperative Association, Ralston, Iowa, was provided information on collecting, processing, and utilization of corncobs.

North Bolivar Co-op Mound, Bayou, Mississippi, was provided, through a consulting firm, information on possible future business possibilities. This all-minority group co-op owns 15,000 acres and has 500 members in Mississippi. The completed proposals were also reviewed.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

Sellers, Kirk and Co., Inc., Ambler, Pennsylvania, was provided with information on food uses of vegetable fats and cereal products for use in its developments.

Loveland Industries, Loveland, Colorado, was provided information and technical guidance on the physical and chemical properties of xanthan gum for possible use in pesticides, herbicides, and similar agricultural materials.

Koval Enterprises, Leonia, New Jersey, was provided information concerning sugarcane bagasse.

Elnedo, Inc., Westmont, Illinois, was supplied information on soybeans, proteins, and protein denaturation.

Mallet and Co., Inc., Carnegie, Pennsylvania, was furnished information covering the entire corn dry-milling industry, including processing, products, and markets.

Perky Pies, Union City, California, was provided with information concerning tofu and other oriental foods including manufacturing and marketing.

Protein Plus Laboratories, Colfax, Illinois, was supplied with information on the chemical, physical, and nutritional properties of soybeans and their food uses.

Living Soil, Inc., Kolona, Iowa, visited Northern Regional Research Laboratory (NRRL) and was provided with detailed information on the manufacture of miso and other oriental foods. This communal group plans to supply miso for their own people and then expand into commercial markets.

Hastro West, Inc., Brownsville, Oregon, was visited and was supplied information on straw collection and uses. New low-cost techniques are under development by this small business.

Pacific Grain Company, Farmer City, Illinois, was provided information on high-amylose corn, including analytical techniques and equipment required for analyses.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

The cotton industry provides millions of jobs on farms and in rural communities. Research contributions to this important segment of the agricultural economy included advice and consultation, in-plant and mill trials, and laboratory and mill tests on a variety of textile operations--for example, processing and finishing cotton goods; application of USDA-developed flame-retardant, durable-press, and weather-resistant finishes; development and use of product testing techniques; and fabrication and optimum use of USDA-designed cotton processing machinery.

Examples of activities in the cotton area are:

Providing information and procedures for imparting flame resistance to fabrics; including on such diversified subjects as selection of the most promising methods of imparting flame resistance (United Merchants Research Center, Langley, S.C.); development of fire-retardant batting suitable for use in mattresses (Lummus Industries, Columbus, Ga.); fire-retardant finishes for blanket fabrics (Beacon Mfg. Co., Swannanoa, N.C.); and ways to incorporate flame retardants in paper air filters for trucks and passenger cars (Riegel Products Corp., Milford, N.J.).

Making recommendations for modification of USDA-designed machinery to enable more efficient trash removal from short-staple waste for special undisclosed uses (Versatech Co., Cooleemee, N.C.); for solving problems in cotton carding and overall processing of textiles (Greenwood Mills, Greenwood, S.C.); and for construction and operation of the USDA-designed sectional card for textile manufacturing (Aldrich Machine Wks., Greenwood, S.C.)

Giving advice on and assistance in: Use of polymer-sized warp yarns in weaving corduroy fabrics (Crompton-Shenandoah Co., Waynesboro, Va.); weathering tests of cotton fabrics (Reeves Bros., Spartanburg, S.C.); use of polyethylene in textile finishing (Cosden Oil Co., Richardson, Tex.); bleaching of cotton gauze and loose cotton stock (Johnson & Johnson, Sherman, Tex.); and use of the zirconium process for improved chrome mineral dyeings having fungicidal properties (Dan River, Inc., Danville, Va.; ABCO Inc., Spartanburg, S.C.; Glen Raven Mills, Glen Raven, N.C.). Engineering and development information was provided for use in the planning and construction of a plant for radiation sterilization of cellulose products (Kimberly-Clark Corp., Nenah, Wis.).

Other commodity areas in rural communities benefited from research, for example:

Personnel concerned with oilseed processing quality received information and training in detection of aflatoxin in grains and feeds via a quick

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

screening test developed by USDA. Not only the rural South but also other areas of the country will be helped by this rapid, sensitive method which has aroused interest for testing corn as well as oilseeds. (Central Lab., Forest, Miss.); Vetenary DX Lab., Florence, Miss.; Yazoo Valley Oil Mill, Greenwood, Miss.; Quaker Oats, Barrington and Paris, Ill. plants).

Foam investigations suggest potential uses as carriers for agricultural chemicals as farm markers and covers following soil fumigation, thereby reducing volume of chemicals required and minimizing environmental contamination. (DeRudder Forest Expt. Sta., DeRidder, La.; Ciba-Geigy, St. Gabriel, La.).

Data on production of sugar from sweet sorghum provided incentive for a cooperative enterprise, Valley Sugar Cane Growers, to make plans to construct a sugar mill in the Rio Grande Valley, where a 100,000 ton quota for sugar production was obtained. The mill will process sugarcane initially, but provisions are being included for sorghum operations when that process is perfected.

Development of expanded markets for peanuts was encouraged by advice and assistance on peanut processing problems, air classification, production of peanut flours, concentrates, isolates, and partially defatted peanuts. (Seabrook Blanching Co., Edenton, N.C.; Gold Kist Corp., Graceville, Fla.).

Counsel and assistance were provided on canning sweetpotatoes, including modifications and processing of flakes necessitated by problems arising in a changeover to new sweetpotato varieties, and on application of drum drying to sweetpotato waste (peel and trimmings) for feed use. (B. F. Trappey's Sons, Princeville, La.; Joan of Arc Co., St. Francisville, La.; Overton Machinery Co., Dowagiac, Mich.).

Technical advise on citrus processing in the Rio Grande Valley helped launch a new processing firm in south Texas. The enterprise was given quality standards for citrus concentrate and processing procedures to attain them; their orange concentrate consequently was upgraded considerably. (Agri-Business Mgmt., Inc., Monte Alto, Tex.).

Advice was given on dry caustic peeling for possible use in the production of frozen french fried potatoes, and eventually for peeling table beets, carrots, and similar vegetables grown in the Rio Grande Valley (Vahlsing Frozen Foods, Monto Alto, Tex.). Use of Valley-grown avocados will increase as a result of demonstration of an avocado peeling machine for a puree-type product to be incorporated into Mexican-style prepared foods. (Riviana Foods).

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(G) Rural Community Development Activities (contd.)

Information was supplied on rice products (snacks, canned, frozen, instant breakfast cereal and convenience products, and extruded rice). A cooperative group hopes to establish new industry based on rice, the principal agricultural product in their community, Mermentau, La. Suggestions were made for measures to prevent disintergration of rice kernels in canned gumbo. (Lazy River Canning Co., Denham Springs, La.).

Phase separation of product during reaction, enabling production of rosin-dimer acid on a continuous basis, was outlined for a company contemplating restarting a dormant plant. Information on a liming process to clean up wash water from naval store processing plants, eliminating further treatment prior to discharge into sewers, was furnished. (Filtered Rosin Prods. Co., Baxley, Ga.; Union Camp Co.). Advice and assistance were also provided in efforts to find profitable uses for large quantities of Ponderosa pine stumpwood in Western states, especially Arizona.

Technical details were supplied to Arizona rural development agencies on dehulling and extraction of jojoba seed as a foundation for establishing plants to process this seed in rural Arizona. (Dept. of Arid Land Studies, Univ. of Ariz., Tucson).

Continuing counsel and assistance were furnished in adoption of the liquid cyclone process for production of food-grade protein concentrates and isolates and in evaluation of these products for various food and feed end uses. (Plains Cooperative Oil Mill, Lubbock, Tex.; Grain Processing Co., Muscatine, Iowa).

In addition to the specific contacts mentioned, several conferences sponsored by USDA were attended by numerous representatives of firms based in rural communities that are concerned with processing agricultural crops. Information developed through research thus reached an audience vitally concerned with the subject matter. Conferences fulfilling this mission were:

21st Oilseed Processing Clinic
18th Annual Joint Conference of Cooperative Oil Mills
Conference of Collaborators from Southern Agricultural Experiment Stations
12th Cotton Utilization Research Conference

Commercialization of a process for treating washable leather. A non-exclusive license was issued to two companies for use of the patent. One company is located in Gloversville, N.Y., while the other is located in Peabody, Mass.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

New types of harvesters were introduced and used in large numbers for the harvest of the sweet cherry crop (Michigan). Cooperative research among personnel of Eastern Regional Research Laboratory (ERRL), agricultural engineers of ARS and of the Michigan Agricultural Experiment Station has as its objective to attack the unique problems of mechanical harvesting sweet cherries under conditions to maximize yield and preserve quality.

Projects were completed on preharvest treatment and on improved handling of the fruit in sweet cherry research (Michigan). Commercial-scale tests showed that fruit yield could be increased from about 80% to about 95% recovery through the spraying of Ethrel, an abscission-inducing chemical. Another project involved the development of a method for buying sweet cherries by volume. A new and legal method for the buying and selling of sweet cherries in brine should lead to marked improvement in quality.

Cooperatively with the ARS Agribusiness staff and ERS, plans were formulated for extending the demand for products from sheep grown by Navajo Indians in the southwest. Funds were later allocated for the custom production of new lamb products in quantities sufficient for evaluation in institutional food outlets. Also, the head chief of the Navajo tribe at Window Rock, Arizona, is being offered help in setting up a shearling tannery.

On-the-farm processing of tart cherries is progressing satisfactorily. This movement is improving growers' returns thus far and also providing better quality product. About 800 farm markets are now functioning in Michigan, and it is not unusual for a farmer to gross $600 on a weekend. This work is done in cooperation with the ARS agricultural engineers stationed at Michigan State University.

Assistance is being rendered to the Bureau of Indian Affairs in establishing a cheesemaking industry using the milk of sheep to be raised on the Cattaraugus Reservation for the Seneca Indians in western New York state. If successful, the Bureau plans to develop, with our assistance, a similar project among the Navajos in the southwest.

As a result of a contract with the Cooperative Extension Service at West Virginia University, a final report was submitted on the "Evaluation of sugar maple resources of West Virginia related to location requirements for a central maple sap processing plant." Workshops are planned for fall and winter 1972-73 at which discussions are to be held with West Virginia farmers regarding the requirements for establishing a maple industry and for marketing the products.

II MAKING UTILIZATION RESEARCH INFORMATION AVAILABLE (contd.)

(C) Rural Community Development Activities (contd.)

The experimental palletbox hydrodumper developed at Russell Research Center by A. H. Bennett, W. R. Forbus, and J. H. Adams, Fruit and Vegetable Laboratory was commercially tested during the 1971 peach season at the Mallory Mountain Orchards Packinghouse at Thomaston, Ga. The equipment was installed in the commercial packing line and was operated by plant personnel during the entire packing season. Results showed that the equipment is commercially feasible, since a production rate of approximately 400 bushels per hour can be maintained by one worker. Projected economic advantages of the experimental equipment over existing commercial dumpers with comparable production capacities include lower equipment costs, a reduction in labor requirements, and a reduction in bruise-injury to fruit. Plant management was extremely pleased with the performance of the equipment and requested that further tests be conducted in their facility during the 1972 peach season. Work to develop an improved, complete handling system incorporating the dumper was continued during fiscal year 1972.

Gold Kist, a farmers' cooperative, collaborated with Russell Research Center scientists to evaluate peanut hulls as roughage in beef cattle rations. One hundred-sixty cattle were obtained for fattening at Gold Kist's new feedlot in Waynesboro, Ga. Computer-formulated rations containing different levels of peanut hulls were developed by the Forage and Feed Laboratory. In addition to animal performance data, information on any pesticide buildup during the feeding period was to be followed. Gold Kist Livestock Division conducted the feeding trial under supervision of RRC personnel. The Georgia Health Department cooperated in making biopsies and our Forage and Feed Laboratory ran the pesticide analyses. Results are being analyzed.

## III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS

Cooperative work with other groups is undertaken to develop new products, improve existing products and processes, devise economic processes for product manufacture, evaluate products and processes, and explore new outlets for agricultural products. These cooperative efforts contribute to early commercialization and broadened usage. Examples of cooperative research and development conducted in F.Y. 1972 are as follows:

| Activity | Cooperators with USDA |
|---|---|
| Wet processing of alfalfa | Dixon Dryer Co., Dixon, Calif., and National Alfalfa Dehydrating and Milling Co., Shawnee Mission, Kans. |
| Pollution control and product improvement in the dehydration of forages | American Dehydrators Association, The Heil Co., Milwaukee, Wis., and Cornhusker Farms, Grand Island, Nebr. |
| Processing of bagasse and pineapple and sugar cane field wastes for feed | University of Hawaii, Honolulu and Hilo |
| Processing rice straw for animal feed | Butte County (Calif.) Rice Growers Assn. and Univ. of Calif., Davis and Hopland |
| Investigation of unidentified growth factor in alfalfa | Univ. of Calif., Berkeley |
| Feed products from kenaf tops | Weyerhaeuser Company, Tacoma, Wash., and Univ. of Calif., Davis |
| Processing of sawdust for feeds | South Dakota State Univ., Brookings |
| Development of information for a Millfeed Manual | Millers' National Federation, Chicago |
| Agricultural by-products for removal and recycling of lead | Electric Storage Battery Co., Milpitas, Calif. |
| Agricultural by-products for removal and recycling of mercury | Buena Vista Mines, Paso Robles, Calif. |
| Armor layers in insect resistant oilseed plants | Univ. of Calif., Davis |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Recovery of feed supplement from pepper wastes | Heublein, Inc., Oxnard, Calif. |
| Processing of sugar beet tops | Spreckles Sugar Company, AMSTAR Corp. Mendota, Calif. |
| Study of toxic factors in jojoba for feed use | Univ. of Calif., Riverside |
| Hot air popping of wheat | Carnation Co., Van Nuys, Calif. |
| Debranning wheat | Peavey Co., Chaska, Minn. |
| Use of expeller soy grits in soy fortified bulgur | Universal Proteins, Inc., Minneapolis, Minn. |
| New iron enrichment compound | Pillsbury Co., Minneapolis, Minn.<br>Gerbers, Inc., Oakland, Calif. |
| Pericarp removal from corn for use in masa by hot air treatments | RJR Foods Co., Winston Salem, N.C. |
| Reduction of Biological Oxygen Demand (BOD) in brewery spent grain liquor | Feedstuffs Inc., San Francisco, Calif. |
| Specifications for and improvement of soy fortified bread wheat flours | C. J. Patterson Co., Kansas City, Mo. |
| Examination for possible asbestos fiber intake used to coat rice | Univ. of Calif., Berkeley, and State Dept. of Public Health, Berkeley, Calif |
| Determination of genetic control of gliadin components in crossing wheat varieties | Dept. of Agronomy and Range Science, Univ. of Calif., Davis |
| Modified processing for sourdough bakery products | Colombo Bakeries, Oakland, Calif.<br>Larraburu Bros., San Francisco, Calif.<br>Safeway Stores, San Jose, Calif. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Plant development of solvent-based process for machine washable woolen fabric | Carleton Woolen Mills, Winthrop, Maine |
| Development of wool/cotton yarn for men's sweaters | Demetre, Seattle, Wash. |
| Pill-resistant wool throws | Three Weavers, Houston, Tex. |
| Washable men's worsted sweaters | Puritan Sportswear Corp., Altoona, Pa. |
| Washable worsted plaid fabric | Worchester Textile Co., Centerdale, R.I. |
| Dry caustic peeling of fruits to reduce pollution | Natl. Canners Assn., Berkeley, Calif. |
| Pre-processing and bulk storage treatments for cling peaches | Cling Peach Advisory Board, San Francisco, Calif. |
| Recovery and re-use of salt from pickling brines | H. J. Heinz Co., Pittsburgh, Pa. |
| Control of microbiological contamination of dried fruits and nuts | Dried Fruit Association of Calif. Santa Clara, Calif. |
| Preservation of high-moisture dates | Calif. Date Administrative Committee |
| Enzymic processing and vacuum hydration of dates | Cal-Date Co., Indio, Calif. |
| Processing of mechanically-harvested grapes | Fresno State College, Fresno, Calif. |
| Market testing of frozen, quick-cooking beans | Oxnard Frozen Foods Coop. and China Doll, Inc. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Improved bean products | Lima Bean Advisory Board and Calif. Dry Bean Advisory Board |
| Commercial evaluation of IQB (individual quick blanch) process | Patterson Frozen Foods, Patterson, Calif. |
| Chemical manipulation of *Clostridium botulinum* spores | National Canners Assn., Berkeley, Calif. |
| Survey of aflatoxin in tree nuts | DFA of California and Walnut Control Board |
| Chemical determination of nutritional status | Stanford Univ., Palo Alto, Calif. |
| Studies on potato processing quality | Univ. of Calif., Davis, and Oregon State Univ., Corvallis |
| Development of stabilized enzymes for food processing | Foremost Research & Development Center, Dublin, Calif. |
| Commercial evaluation of acid-break process for tomatoes | Contadina Foods, Inc., and Dow Chemical Company |
| Protective constituents of marine-borer resistant woods | Naval Research Laboratory, Washington, D.C. |
| Toxic effects of cinnamyl phenols on freshwater fish | Fish Control Laboratory U.S. Dept. of Interior |
| Inhibition of dental caries by obtusastyrene | Warner-Lambert Co., Morris Plains, N.J. |
| Commercial evaluation of sub-atmospheric steam scalding of poultry | Foster Farms, Livingston, Calif. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Evaluation of improved egg pasteurization process | Pacific Growers (Nulaid), San Leandro, Calif., and Thayer Egg Co., Oakland, Calif. |
| Stability of ground turkey meat products | Ralston Purina Co., Modesto, Calif. |
| Nuclear magnetic resonance study of organic compounds | U.S. Forest Service, Berkeley, Calif., and Dept. of Environmental Toxicology, Univ. of Calif., Berkeley |
| Development of a mass spectral analytical method for creatinine | Dept. of Nutrition, Univ. of Calif., Berkeley |
| Raman Scattering studies | Dept. of Chemistry, Univ. of Calif., Berkeley |
| Detecting and characterizing nitrosoamines | Eppley Institute for Cancer Research Omaha, Nebr. |
| Computer programs and X-ray crystallography | Lawrence Radiation Laboratory, Berkeley, Calif. |
| Utilization of linseed oil in protective coatings | National Flaxseed Processors Association (Memorandum of Understanding (MOU)--indefinite) |
| Utilization of linseed oil for concrete protection | National Flaxseed Processors Association and several state highway departments (no formal agreement) |
| Utilization of linseed oil on concrete | Illinois Institute of Technology (Purchase Order (PO) dated 6/22/72) |
| Heavy metals in corn research | American Corn Millers Federation (no formal agreement) |
| Heavy metals in corn grown on sludge-treated land | Chicago Sanitary District (no formal agreement) |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| High-lysine analytical procedures | Pfister Associated Growers (PAG)<br>Pioneer Hybrid International, Inc.<br>Funk Bros. Seed Co.<br>(no formal agreement) |
| Analysis of some 8,000 corn samples per year for amylose content to guide geneticists in developing high-amylose corn for industrial use | Bear Hybrid Corn Company, Inc.<br>(MOU--indefinite) |
| Investigations on the development of superior plant sources of vegetable oils of high-erucic acid content | Oregon Agricultural Experiment Station (Cooperative Agreement (CA)) |
| Separation of chopped T. vogelii plants into leaf and stem fractions to improve retenoid yield | Bauer Bros. Company (Standard Memorandum of Understanding (SMOU)) |
| Testing effects of toxic hay | University of Missouri<br>(PO dated 12/8/71) |
| Utilizing crambe seed meal in lamb feeding tests | University of California at Davis<br>(PO dated 9/16/71) |
| State-Federal cooperation on problems of interest to agriculture, forestry, and rural people in the State of Louisiana | Southern University and Mechanical College (CA) |
| Kenaf tops in Pro-Xan process | University of California at Davis, Plant Science Research Division, Western Regional Research Laboratory (WRRL), and Northern Regional Research Laboratory (NRRL) (no formal agreement) |
| Development of new fiber crops | Weyerhaeuser (paper company) (no formal agreement) |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Green kenaf for processing studies | Indiana Agricultural Experiment Station (no formal agreement) |
| Green kenaf for processing studies | French Oil Mill Machinery Co. (PO dated 9/14/71) |
| Commercial feasibility of producing crambe meal suitable for use in livestock feeds | Vincennes University, The Agri-Business Program, and NRRL (STMOU) |
| Cationic aminoethyl yellow corn flour | Illinois Cereal Mills (no formal agreement) |
| Evaluation of cationic flour and starch-graft polymers | Riverside Paper Corporation (STMOU) |
| Evaluation of cationic flour and starch-graft polymers | George A. Whiting Paper Company (STMOU) |
| Evaluation of milling characteristics of artificially-dried corn | The College of Agriculture University of Illinois (STMOU) |
| Iron fortification of corn grits | Spencer Kellogg (now Gooch Milling), Division of Textron, Inc. (STMOU) |
| Textiles and clothing research | University of Tennessee |
| Flame- and smolder-resistant cotton batting products | Cotton Incorporated National Cotton Batting Institute |
| Functional properties and chemical characteristics of cottonseed protein products | Cotton Incorporated National Cottonseed Products Association |
| Nutritional value of cottonseed products processed by new and improved methods | Louisiana State Agricultural Experiment Station |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Shelf life of roasted Southwest peanut products | Southwest Peanut Research Committee |
| Determination of consumer acceptance of selected fruit and vegetable products | The Texas A&M University<br>The Texas Agricultural Market Research & Development Center |
| Processing characteristics, product quality, and potential new uses of southern-grown fruits and vegetables | Texas Agricultural Experiment Station |
| Characteristics of sweet sorghum cane and other sugar-bearing crops to determine suitability for sugar recovery | Texas Agricultural Experiment Station |
| Light-weight, low-cost agrifoams from agricultural products | Louisiana State Agricultural Experiment Station |
| A pilot plant study with potato starch factory waste effluent to demonstrate that an economical nutritious animal feed can be produced | Carver-Greenfield Corp., Hanover, N.J. |
| Research to eliminate light colored spots from the finished product that has undergone a full grain aniline finish | W. D. Byron & Sons, Hagerstown, Md.; Dairy Cattle Research Branch, Beltsville, Md.; Entomology Research Div., Kerrville, Tex. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Project on the incidence of mites in livestock and the variable effects of such infestations on leather | Veterinary Sciences Research Division, Albuquerque, N.M. |
| Evaluation of new forms of comminuted and fibrous dispersions of collagen from animal hides | General Foods, Ralston Purina, Superior Pet Products |
| Trial lots of a dehydrated form of a selective medium for Salmonella | Bioquest, Division of Baltimore Biological Laboratories |
| Development and market trials of milk-orange juice drink, iron fortified whole milk, and whey-fat spread | Dairy Development, Division of Dairy Research, Inc. (an R & D organization supported by Northeastern states dairy cooperatives) |
| Isolation, identification and distribution of purified samples of solanine | At least 15 industrial, governmental and educational institutions |
| Dry whole milks, fruit juice powders, and explosion-puffed dehydrated fruit and vegetable products | U.S. Army Laboratories, Natick, Mass. |
| Production of "protected" safflower oil and "protected" full-fat soy flour for feeding dairy cows to evaluate the polyunsaturated fat content of milk | Dairy Cattle Research Branch, ARS, Beltsville, Md. |
| Evaluation of sperm oil substitutes | Reilly, Whiteman and Walton Co.; Mayco Inc.; William Amer & Co.; Mobile Oil Corp.; Quaker Chemical Co. |
| Evaluation of vacuum foam dried whole milk | General Foods Corp. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Building a continuous elution chromatography apparatus | Mobil Research & Development Corp. |
| New containers for shipping potatoes and the evaluation of known varieties and cultured history of potatoes for explosion-puffing research | University of Maine's Experimental Farm at Presque Isle and Market Quality Laboratory, Belle Mead, N.J. |
| Removal of meat from bones using the explosion-puffing process | McCormick & Co. |
| Biodegradable soap plus lime soap dispersing agent formulations for home laundering | Connecticut State Legislature and the Environmental Protection Agency |
| Evaluation of dried potato solubles as a component of poultry feed | University of Maine |
| Studies with specific ion electrodes to control brine concentrations | Denison Hide Company, Denison, Iowa |
| Processing and evaluation of pale, soft, exudative pork | Department of Animal Sciences, University of Georgia |
| Pollution research -- improved methods of blood collection in poultry processing | Central Soya Company, Athens, Ga. |
| Integration of research programs | Botany Department, University of Georgia |
| Investigating chemical constituents in Coastal bermudagrass pellets | Coastal Bermudagrass Processors' Association, Estill, S.C. |
| Study of chemical composition of sunflower hybrids and inbred lines | Oilseed and Industrial Crops Research Branch, ARS, USDA College Station, Tex. |
| Basic studies on the properties of sunflower important to food use | Texas Agricultural Experiment Station, College Station, Tex. |

III COOPERATIVE RESEARCH WITH OTHER ORGANIZATIONS (contd.)

| Activity | Cooperators with USDA |
|---|---|
| Smoke condensate preparation, fractionation and analysis | Tobacco and Health Research Institute, University of Kentucky |
| Chemical analysis of tobacco, tobacco leaf extracts and fractions thereof | College of Agriculture, University of Kentucky |
| Ultrastructural analysis of respiratory tissue response to cigarette smoke | School of Medicine, University of Kentucky |
| New cytogenetic techniques in studying the effect of tobacco smoke on chromosome aberrations | School of Medicine, University of Kentucky |
| Pyrolytic interactions between maleic hydrazide and tobacco | Department of Chemistry, University of Kentucky |
| Metabolism of benzo(a)pyrene in rats with different orders of susceptibility to sarcoma | School of Medicine, University of Kentucky |
| Effect of tobacco smoke on the formation of a microbial membrane-bound electron transport system | School of Medicine, University of Kentucky |
| Fabrication and characterization of experimental cigarettes | Tobacco and Health Research Institute, University of Kentucky |
| Bioassay of cigarette smoke constituents by hyperplasia-sebaceous gland tests | Tobacco and Health Research Institute, University of Kentucky |

## IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS

### (A) Planning and Advisory Activities

The USDA program of utilization research on farm commodities is the product of extensive planning that is continually updated. Its administration has been the direct responsibility of a deputy administrator of the Agricultural Research Service, his supporting staff, and the directors of the five regional research laboratories. A Program Development Staff of ARS, composed of economic specialists has assisted this administrative group in evaluating the appropriateness and commercial feasibility of proposed and existing utilization research projects. Information and guidance are sought from various other sources both within and outside the Department. Among the advisory groups that oversee the program, the following may be mentioned:

Agricultural Research Policy Advisory Committee. This committee, established in 1969, has for co-chairmen USDA's Director of Science and Education and the president of a land-grant college or university. USDA representatives include the administrators of the Agricultural Research Service, Cooperative State Research Service, Economic Research Service, Farmer Cooperative Service, and Statistical Reporting Service, and the deputy chief for research of the Forest Service. State representatives include an Agricultural Experiment Station director from each of four agricultural regions, and representatives of the National Association of State Universities and Land-Grant Colleges, the Association of State College and University Forestry Research Organizations, and the Experiment Station Committee on Organization and Policy.

The objectives of this committee are:

(1) To develop recommendations for policy with respect to planning, evaluating, coordinating and supporting unified long-range agricultural research programs and delineating the appropriate areas of responsibility of Federal and State agencies in carrying out these programs. The term "agricultural" is used in the broadest sense, including forestry, other renewable natural resources, and rural life.

(2) To develop further the bases for State and Federal cooperation in planning and implementing regional and interstate research programs. This will include cooperation among Federal agencies, among the State stations, and between Federal agencies and State stations.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(A) Planning and Advisory Activities (contd.)

Agricultural Associations and Industry Groups. Advice is sought from, and information is exchanged with, all segments of the agricultural industry, including growers, shippers, processors, and distributors, concerning the many problems involved in the profitable development of new or improved uses for agricultural commodities.

Consumer Interests. Information on consumer desires for new or improved products, and on evaluation of such products, is sought through contacts with consumer groups of national and regional scope. Other USDA groups--the Economic Research Service, the Federal Extension Service, and the ARS marketing and consumer use research groups--provide advice on consumer needs and market trends.

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection

The utilization research program is continually reviewed to assess its fruitfulness. Investigations that have reached their objectives are discontinued. Investigations that have passed the point of maximum returns, or are otherwise relatively unproductive, also are discontinued so that the resources may be more effectively applied to new programs. More promising investigations are established or intensified, either by reduction of effort on projects of lesser importance or by use of such new resources as may become available. Examples of the redirection of research effort are shown below:

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Cereal and Forage Crops** | |
| Dialdehyde starch-protein glue for hardwood plywood | Sustained-release pesticide-starch products |
| Research on use of starch in rubber | Production and properties of starch-filled powdered rubber |
| Studies on conversion of starch to sugar by immobilized enzymes | Continuous process for immobilized enzymatic conversion of starch |
| Molecular structure of wheat gluten proteins | Gluten protein characteristics related to performance of new wheat varieties |
| Effect of enzymes on microscopic structure of wheat and flour | Enzymic modification of wheat milling fractions |
| **Fruits and Vegetables** | |
| Analytical studies of the flavor components of fruit products | Effects of processing and pre-processing variables on flavor of fruit products |
| Improved dried fruit products | Processing and pre-processing modifications to improve quality of fruit products |
| Processability of mechanically harvested dates | Development of more stable, longer shelf-life dates for export |

IV PROGRAM MODIFICATION MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| Fundamental study of heat resistance of spores | Enumeration and control of spores in processed vegetables |
| Effects of processing variables on texture of canned vegetables | Improved blanching, freezing and enzymatic processes for vegetables |
| Identification of compounds contributing off-odors and off-tastes to vegetable products | Elimination of hazardous or undesirable compounds naturally occurring in vegetable foods |
| Improved processed products for Texas citrus grown under different conditions | Natural components of whole-citrus products of nutritional and biological importance |
| Development of comminuted whole fruit powders, pastes, purees and beverage products from oranges and grapefruit | Factors influencing quality of whole-fruit citrus puree and derived products |
| High-quality products from processing southern-grown tomatoes | Improved texture in processed foods made from southern-grown vegetables |
| New sweetpotato product through flavor enhancement and process improvement | Improved processing to decrease pollution and produce high-quality sweetpotato products |
| Identification of compounds responsible for characteristic aroma of commercial red tart cherry essence | Survey of fruit products for Patulin (a mycotoxin) contamination |
| Development of a batch explosive puffing process to provide rapidly rehydratable dried fruit and vegetable pieces | Development of a continuous explosive puffing process, including cost and market evaluations, adaptable to a variety of fruits and vegetables |
| Recovery of useful material from potato waste (decreased effort) | Determination of nitrate content of processed vegetables |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Oilseeds** | |
| Study of deleterious constituents of safflower seed and meal | Development of improved feeds from Western oilseed meals |
| Studies on production of full-fat soy flour by extrusion-cooking | Optimization of continuous processes for full-fat soy flour |
| Recycle washing of soybean oil for reduction of water pollution | Alkali-refined soy oil soapstock as a feed adjunct |
| Minor constituents responsible for undesirable soybean characteristics | Removal of beany and bitter soybean components |
| Internally plasticized films from crambe oil derivatives | Lubricants from new seed oils |
| Effect of variety and history on chemical components of processed peanut aromas | Chemical changes in staling of processed peanut products and means for inhibiting staling |
| Methods of detecting mold and mycotoxins in peanuts for quality control | Inactivation chemistry and origin of mycotoxins produced in peanuts by molds |
| Practical commercial-scale processes for inactivation of aflatoxins in cottonseed meal | Pilot-plant removal or destruction of aflatoxins in cottonseed products |
| Mycotoxins elaborated by fungi found on cottonseed | Improved methods to detect and determine aflatoxins |
| Isolating cottonseed protein by mechanically isolating intact aleurone grains | Simultaneous extraction of oil and protein from cottonseed using aqueous media |
| Polar solvent soluble components of cottonseed | Identification and elimination of constituents that impair protein quality of cottonseed flours |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| New low fat peanut products and practical processes for their production | New protein fortified food products containing peanuts and peanut flour |
| **Poultry, Dairy and Other Animal Products** | |
| Egg pasteurization studies (reduced) | Development of economical new turkey meat products |
| Processing to reduce bacteria in poultry meat products (reduced) | Studies to improve detection of *Clostridium perfringens* in foods |
| Evaluation of commercial potential of vacuum foam dried whole milk | Engineering research to increase utilization in foods of cheese whey solids |
| Properties and interaction of milk proteins | Mineral and vitamin fortification of milk |
| Molecular structure of milk proteins in solution | Physical and chemical alteration of whey proteins during processing |
| Lubricants from animal fats (decreased effort) | Surface active agents from whey byproducts and animal fats |
| Fundamentals of physicochemical separation of animal lipids | New products from edible animal fats |
| Improved processing of hides, including practical production of shearlings | Recovery of proteins from lime-sulfide unhairing effluents |
| New methodology for determining condition of cured and pickled hides (decreased effort) | Conversion of hide protein wastes into amino acids or simple cell protein |
| Engineering study of "wet-end" leather manufacturing operations | Development of commercially feasible method for producing an edible dispersion of cattlehide (increased effort) |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| **Cotton, Wool, and Other Fibers** | |
| Equipment for efficiently carding low-quality cottons | Improved carding and drawing equipment for blending cotton and synthetic fibers |
| Mechanisms and kinetics of reactions of cotton with N-methylolated compounds | Organic liquids and azeotropes as solvents for chemical modification of cotton |
| Durable links to cotton cellulose from highly reactive agents | Low formaldehyde-releasing activated crosslinking agents for durable-press cottons |
| Reactions of cotton with heterocyclics in nonaqueous media | Highly reactive cottons as substrates to improve the overall performance of easy-care end products |
| Nonaqueous treatment to improve fabric properties and reduce water pollution | Liquid ammonia treatments for cotton textiles to reduce stream pollution |
| Durable-press cotton, highly resistant to hydrolysis and formaldehyde release | Durable-press cottons amenable to universal simple laundering and for home-sewing market |
| Structure of reaction products from N-methylolated reagents under cotton crosslinking conditions | Heat-sensitive reversible crosslinks in cotton and cotton-polyester blend fabrics |
| Structures of unmodified and crosslinked cottons and relation to performance | More effective flameproofing of cotton through the study of basic principles |
| Improved durable-press cottons by substitution at cellulosic carbon atoms | Durable-press cottons with electronegative substituents for improved performance |
| Safer cotton textiles through vapor-phase reactions to impart flame retardance | Flame retardants to meet standards for mattresses, bedding accoutrement, auto seats and furniture |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(B) Program Appraisal and Redirection (contd.)

| Old Lines of Research Terminated or Redirected | New or Expanded Lines of Research to Replace Previous Activity |
|---|---|
| Caustic sorptivities of cottons after smooth-drying treatments | Alteration in physical properties of cottons caused by flame-retardant treatments |
| Methods of abrasion evaluation which best correlate with fabric service wear | Methods for evaluating fire- and flame-resistance of fire-retardant fabrics |
| Impregnation of cotton batting raw-stock with improved flame retardants | Flame and smolder resistant cotton products suitable for use in mattresses |
| Methods for the efficient carding of discount cottons | Improved carding techniques for blends of cotton and synthetic fibers |
| Enhancing and controlling activity of cotton fibers in electrostatic and magnetic fields | Corona treatment of cotton and cotton synthetic blends |
| Free-radical reactions of cotton to make durable press products | Wet processing of cotton by free-radical reactions to make flame-resistant, durable-press textiles |
| | New and Special Plants |
| Diamines and iiisocyanates from rosin derivatives | Polyisocyanates from resin acids in urethane condensation polymers |
| Condensation-type polymers from ponderosa pine stump-wood oleoresin | Ponderosa rosin of improved color and softening point for use in condensation polymers |
| Development of methods for purifying sweet sorghum juices which will permit practical recovery of their sugar content | Pilot plant processing of sweet sorghum juices for sugar recovery |

IV PROGRAM MODIFICATION TO MEET CHANGING NEEDS (contd.)

(C) Status of Research Projects

Summary of Actions

| | Active at beginning FY 1972 | Initiated or revised | Terminated | Active at end FY 1972 |
|---|---|---|---|---|
| Domestic | 400 | 124 | 135 | 389* |
| Foreign (P.L. 480) | 22 | 11 | 15 | 18 |
| Total | 422 | 135 | 150 | 407 |

*Includes 49 domestic contract and grant projects.

Commodity Classification of New Research Projects Undertaken in FY 1972

| | Domestic | Foreign | Total |
|---|---|---|---|
| Cereal and forage crops | 21 | 1 | 22 |
| Cotton, wool, and other fibers | 24 | 5 | 29 |
| Fruits and vegetables | 23 | 1 | 24 |
| Oilseeds | 16 | 1 | 17 |
| New and special plants | 13 | 1 | 14 |
| Poultry, dairy, and other animal products | 27 | 2 | 29 |
| Total | 124 | 11 | 135 |

(D) New or Expanded Research Initiated with Appropriation Increases in FY 1972

Studies on effect of Southern Corn Leaf Blight damage on characteristics of corn grain, including study of secondary infection potentialities ($27,000). (Expansion of existing in-house program.)

## V CURRENT UTILIZATION RESEARCH PROGRAM

USDA's utilization research program is directed to finding new or improved uses and improved processing methods for agricultural commodities through basic, applied, and development research. As previously indicated, it is subject to continual review and appraisal at all levels, from Work Units (limited assignments involving up to several man-years of effort for periods of not more than five years) up through broad general areas of activity. Within the general framework of new uses, and in response to recommendations of advisory groups, special attention in recent years has been given to safety of food and feed products as concerns natural toxins, chemical additives, and inadvertent contaminants; to development of products specifically suited to export markets; and to development of modifications in the processing of agricultural commodities that will minimize air and water pollution problems.

The following listing of subject fields will illustrate the general nature of the current program. These are fairly broad areas, some of which have been mentioned in previous reports, while others are new.

### Cereal and Forage Crops

New and improved food products--Improved physical properties of wheat doughs; improved quality of frozen unbaked bread; new and improved rice products with better nutritive value and other quality factors; improved maturation of wheat flours; new and improved high protein wheat foods for export; improved baking performance of blended spring and winter wheats; recovery of food protein from leaf meal; processes to fortify bread and cereal products with nutrients such as iron.

New food products from corn and sorghum; determination of nutrients in corn and corn foods; improved sweeteners from corn starch; milling procedures for artificially dried and high-lysine corn; survey of microorganisms in corn milling fractions; improved yield and quality of wheat milling fractions. New practical procedures for increasing rice milling yields.

Improved feeds--Improving the nutritive value of alfalfa, wheat, small grains and mill fractions for ruminant, poultry, and swine feeds; dense, stable, concentrated low-fiber forage products for export; separate recovery of protein and other feed nutrients from forages; improvement of feed values of mill by-products, straws, hulls, and other agricultural wastes; reduced environmental contamination during processing.

Analytical methods for mold toxins in corn; identification of mold toxins in tall fescue.

Develop new and improved processing techniques for Southern feedstuffs to supply economical animal feeds of greater palatability, intake, and digestibility for the production of lower cost livestock and poultry in the region.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

New industrial uses--Testing starch graft copolymers for industrial applications; fermentative production of L-asparaginase, a therapeutic factor active against leukemias; industrial gums obtained by fermentation; use of starch derivatives in flame-resistant rigid foams, reinforcing agents for rubber, biodegradable surfactants and detergents, and paper manufacture.

Alleviation of soil, air, and water pollution--Use of cereal grain processing wastes in fermentation processes; conversion of feedlot wastes to feed products.

## Cotton, Wool, and Other Fibers

Improved wool and mohair products--Improved wool and mohair yarns and fabrics requiring minimum upkeep by treatments that impart shrinkage control, permanent creases, wrinkle resistance, soil resistance and release, flame proofing, insect resistance, etc.; improved fabrics from wool and mohair blends; new processes to reduce polluting liquid wastes in processing and treating wool and wool products.

Cotton chemical processing--Improved durable-press cotton fabrics; cotton products with improved soil resistance, launderability, and drying characteristics; cotton products with greater resistance to mildew, rot, and air pollution; flame-retardant cotton products with other desirable properties; finishing processes for cotton and cotton blend fabrics; chemical finishing of knitted cotton fabrics for household and apparel textiles; reduction of stream and air pollution resulting from the processing of cotton textile materials.

Cotton mechanical processing--Improved spinning efficiency and yarn quality; improved prespinning processes; aerodynamic-electrostatic-ultrasonic continuous spinning system; cotton yarns with improved strength, smoothness, and toughness for knit products; yarns and fabrics of improved functional properties by blending cottons with synthetic fibers.

## Fruits and Vegetables

Citrus and subtropical fruits--Citrus products with improved flavor, color, and stability; sweetening agents from citrus flavonoids; improved stability and flavor of nonfrozen subtropical fruit juice concentrates and purees; improved quality and stability of dates for export.

Deciduous fruits and berries--Improved quality and reduced processing costs for fruit products; evaluation of processing characteristics of Pacific Northwest berries and other fruit; improved piece-form and powdered dehydrated fruit products; dried fruit and tree nut products for foreign markets; frozen fruit products with improved texture; improved processes for wine production; control of pollution and conversion of waste products of fruit processing; reduced microbial contamination in processing of fruits; natural product antimicrobials for dried fruit preservation; development of new methods to utilize enzymes in food processing.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Quality products from mechanically harvested cherries, apples and grapes; survey of fruit products for patulin contamination; dewaxing and electronic sorting applied to fruit processing; development of continuous processing technology for producing rapidly rehydratable, quick cooking fruit products.

Vegetables--Frozen vegetables with improved texture; dehydrated vegetables of improved quality and stability for export markets; evaluation of processing characteristics of Pacific Northwest vegetables; control of consistency of tomato products; convenience foods and foods with improved nutrient quality from dry beans and peas; canned low-acid foods of improved quality and safety; control of pollution and conversion of waste products from the processing of potatoes and other vegetables; reduced microbial contamination in vegetable processing; effects of processing on folic acid and other nutrients and antinutrients in vegetable products; processes to remove undesirable or toxic components naturally occurring in vegetables and vegetable products.

Modified and enriched products from sweetpotato puree and flakes.

Determination of nitrate content of processed vegetables; characterization and improved determination of potato glycoalkaloids; improvement of flavor and stability of potato flakes; relationship of chemical and physical properties of fresh potatoes to processing frozen French-fried potatoes; development of continuous processing technology for producing rapidly rehydratable quick-cooking dehydrated vegetable products, recovery of protein and other useful materials from potato processing wastes.

Investigations leading to the development of a broad spectrum of techniques and applications of nondestructive, high-speed, automated quality separations, including color sorting, of fruits and vegetables are underway.

## Oilseeds

Food uses--Improved thermal and oxidative stability of safflower oils; new and improved food products from safflower, sesame, and other western oilseed meals; castor oil derivatives with possible use as emulsifiers or other food additives.

Nutrients in soybeans and soybean food products; improved catalysts for hydrogenating soybean oil; development of high-protein beverages from full-fat soy flours for export markets; removal of undesirable factors from soybean products.

Processes for making new food-grade esters from cottonseed oil fatty acids; confectionery fats and other edible sharp-melting fats from cottonseed oil; edible high-protein cottonseed products; removal or utilization of cottonseed

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

whey constituents to minimize pollution from the preparation of cottonseed protein products; detection and prevention of mycotoxin contamination in cottonseed and peanuts and their food products; new and improved peanut products of improved flavor and stability; high-protein peanut products for export and domestic markets.

To develop fundamental information on the composition, flavor and oxidative stability of sunflower oil as a basis for the efficient and economical conversion of the oil into high quality food products.

Feed uses--Improved animal feedstuffs from safflower, sesame, and other western oilseed meals; production of safe-to-handle nutritious feedstuffs from castor bean meal.

Detection, estimation, and control of mycotoxins in cottonseed and peanuts and their feed products; microbial contamination of cottonseed meal products.

Industrial uses--Utilization of western seed oils in industrial products such as urethane foams, elastomers, films, etc.

Sperm oil replacements from soybean, linseed, crambe, and other seed oils; linseed oil coatings for improving low-grade concrete aggregate; nylon-type plastics from soybean and crambe oils; improved linseed oil paints.

Functional fluids and other industrial products from cottonseed oil.

## Poultry, Dairy, and Other Animal Products

Poultry and eggs--Low-cost, uniform aging of turkey for freezing; process modifications to improve and extend the variety of turkey products; elimination of processing damage to egg products; control of salmonella in poultry meat, liquid eggs, and dried eggs; improved feather removal practices to reduce contamination of product, accumulation of polluting liquid wastes, and toughness of poultry meat.

Improve flavor and texture of broiler products through processing modifications; reduce or eliminate pollution from poultry processing wastes by new procedures to utilize greater percentages of the carcasses, minimize the volume of processing waters, and convert the processing wastes to profitable uses or disposal without pollution hazards; improve plant procedures to minimize contamination of further processed poultry products by microorganisms that affect the quality and wholesomeness of the products.

Dairy products--Mineral and vitamin fortification of milk and engineered dairy foods; enzymatic hydrolysis of lactose in dairy products; characterization of milk systems to improve stability of milk and milk products; new food uses for whey; evaluation of surfactants from whey.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

Animal fats--Plastics, resins, and plasticizers from animal fats; new biodegradable detergents from animal fats; replacement of phosphates in detergent formulations; lubricant components from animal fats; development of reactive chemical intermediates from fatty acids for industrial use; new products from edible animal fats.

Meat products--Control of microbial contamination of meat and meat products through improved processing techniques and improved assay methods; development of rapid analyses for process and product control; improving functional, organoleptic and nutritional values of processed meats; development of improved processing methods for increased stability in meat and meat products; studies on chemical residues in meat resulting from processing with special reference to nitrosamines.

Expand the utilization of pork products by improved technology for processing dry fermented sausages; improved procedures for processing pale, soft, exudative (PSE) pork to lessen shrinkage, maintain quality, and expand use in processed pork products.

Hides and leather--Chemical modifications of leather for easier maintenance and improved wear resistance; lower cost leather manufacturing for industry, including continuous processing; expanded use of collagen in foods, feeds, and industrial products; control of environmental pollution in processing hides and manufacturing leathers.

## New and Special Plants

New alternate crops--New seed sources of industrial vegetable oils from uncultivated plants collected throughout the world; papermaking pulps from kenaf; tumor-inhibiting drugs from plant sources; oils and waxes from new seed oils.

Other crops--Improved yield and purity of refined cane sugars.

Development of new and improved processing methods for maple sap and syrup; better sanitation procedures for maple industry; development of a model maple sap processing facility for rural areas.

V CURRENT UTILIZATION RESEARCH PROGRAM (contd.)

## Tobacco

Develop a safer cigarette without sacrificing organoleptic properties and acceptability and conduct processing studies designed to develop and improve other products and uses of tobacco, such as cigars, pipe tobacco, industrial products, byproducts, and export markets. These objectives will be pursued through interdisciplinary studies on the chemical, physical, biochemical, biological, microbiological, and pharmacological properties of tobacco and its pyrolytic products.

Tobacco research is concerned with: 1) studies for the correlation of chemical constituents of cigarette smoke with the tumor-promoting activity of smoke condensate in animals, 2) the study of the thermal decomposition processes occurring in a burning cigarette, and 3) biochemical studies on processed tobacco.

## VI FINANCIAL INFORMATION

The F.Y. 1972 Obligations and F.Y. 1973 Estimated domestic utilization research and development funds under "Agricultural Research Service," including allocation from the Special Fund for additional labor, are as follows:

| | F.Y. 1972 Obligations | F.Y. 1973 Estimated |
|---|---|---|
| Cereal and forage crops. . . . . | $8,914,451 | $9,164,700 |
| Cotton, wool and other fibers. . . . | 7,601,192 | 8,063,300 |
| Fruits and vegetables . . . . . | 7,080,912 | 7,528,900 |
| Oilseeds . . . . . | 5,537,687 | 5,713,400 |
| New and special plants . . . . . | 3,587,897 | 3,617,000 |
| Poultry, dairy, and other animal products . . . . . | 8,569,525 | 8,960,900 |
| | $41,291,664 | $43,048,200 |

### Supplemental Information

(A) In addition to the domestic program, the equivalent of approximately $793,500 in foreign currencies was obligated in Fiscal Year 1972 for utilization research projects (largely extending over a five-year period) conducted under agreements with foreign institutions. This work is financed by funds generated under the Special Foreign Currency Program.

(B) The Fiscal Year 1973 Appropriation Act included an increase of $1,200,000 for staffing at Athens, Ga.

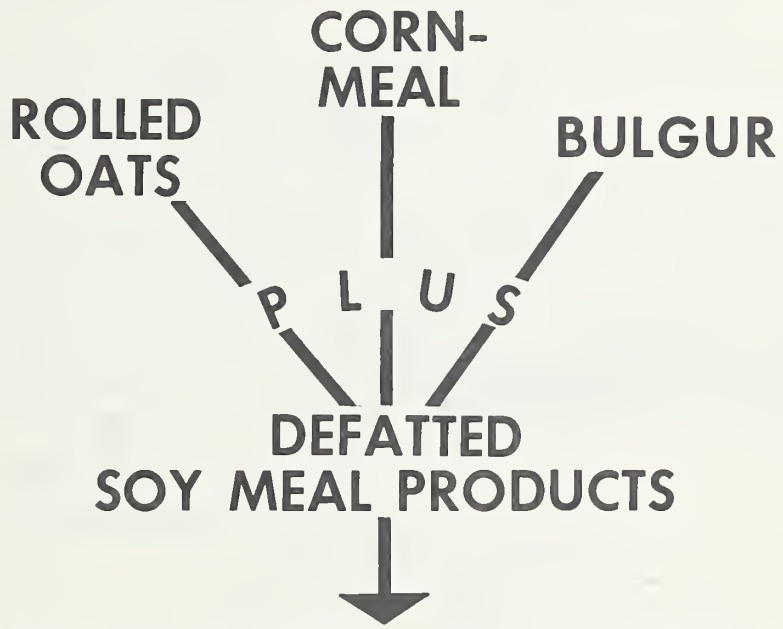
# VII SELECTED RESEARCH ACCOMPLISHMENTS

Examples of the current program of utilization research were given in Section V of this report. In the present section are presented 19 selected examples of recent accomplishments under this program. For the most part, these examples concern research that has proceeded through the applied and developmental stages to the point of commercial acceptance of the processes or products involved. The accomplishments are illustrated on the facing pages.

Nutritional Quality of Cereal Products Is Improved With Added Soy Meal Products

Nutritional properties of cereals and cereal products are improved by the addition of defatted soy products. Studies by Department scientists have shown that up to 15 percent of soy flour or grits can be added to cereal products such as cornmeal, corn tortilla flour, rolled oats, rolled wheat, and bulgur without greatly altering their physical or organoleptic properties. Cereal-soy blends contain at least 30 percent more protein than their cereal components. The additional lysine contributed by the soy products dramatically increases the protein efficiency ratios (PER) of the blends. USDA is currently purchasing soy-fortified cornmeal, rolled oats, and bulgur for the foreign donation program. Soy-fortified cereal products also have excellent potential for upgrading protein quantity and quality of a variety of low-cost familiar foods for domestic use.

# ARS RESEARCH SHOWS NUTRITIONAL QUALITY OF CEREAL PRODUCTS IS IMPROVED WITH ADDED SOY MEAL PRODUCTS




- High-protein cereal products with better balance of essential amino acids
- No change in product characteristics
- No effect on traditional recipes

***USDA CURRENTLY PURCHASING SOY-FORTIFIED CORNMEAL, ROLLED OATS, AND BULGUR FOR FOREIGN DONATION PROGRAM***

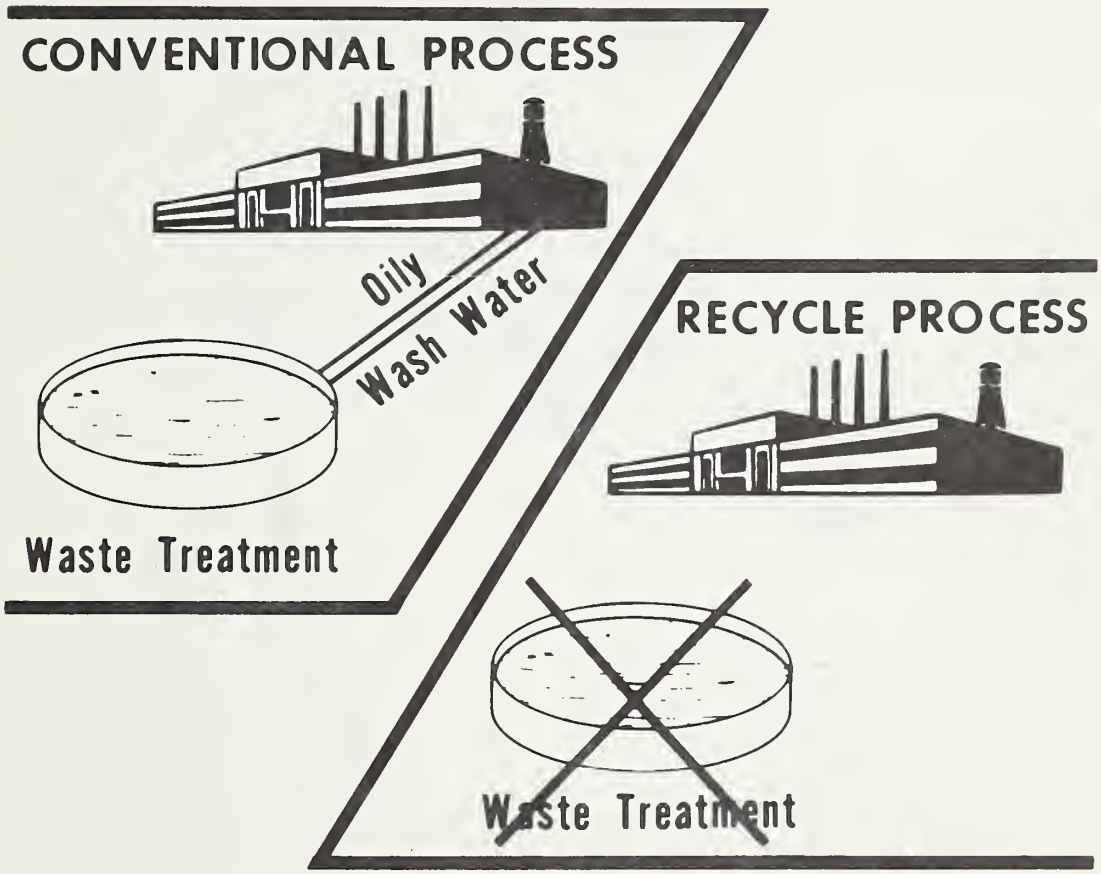
## Recycle Washing of Soybean Oil Reduces Water Pollution and Saves Oil

Department scientists have developed a water-recycle process that utilizes the same water over-and-over for washing alkali-refined soybean oil. The water is treated with a cation exchange resin between uses. A 28-day test, under contract in a commercial refining plant, showed that the recycle method reduced the BOD discharge from 750 to 47 pounds per day (94 percent reduction) on a six-tank car per day (oil) basis.

In conventional commercial practice, the water used to wash alkali-refined vegetable oils is discharged to a treatment plant for removal of polluting substances. This treatment involves a substantial cost to the refiner.

The cost of recycle washing for an automated system was estimated from plant data to be less than 0.5 cent per hundred pounds of oil. However, recycle washing eliminates the 0.5 percent loss of oil that accompanies conventional washing. This increase in oil recovery is equivalent to a savings of about 5 cents per hundred pounds oil or 10 times the cost of recycle washing. Thus, the recycle washing process can effect both a substantial reduction in BOD discharge and an appreciable savings in the cost of plant operation.

# USDA SCIENTISTS DEVELOP NEW RECYCLE WASHING OF SOYBEAN OIL



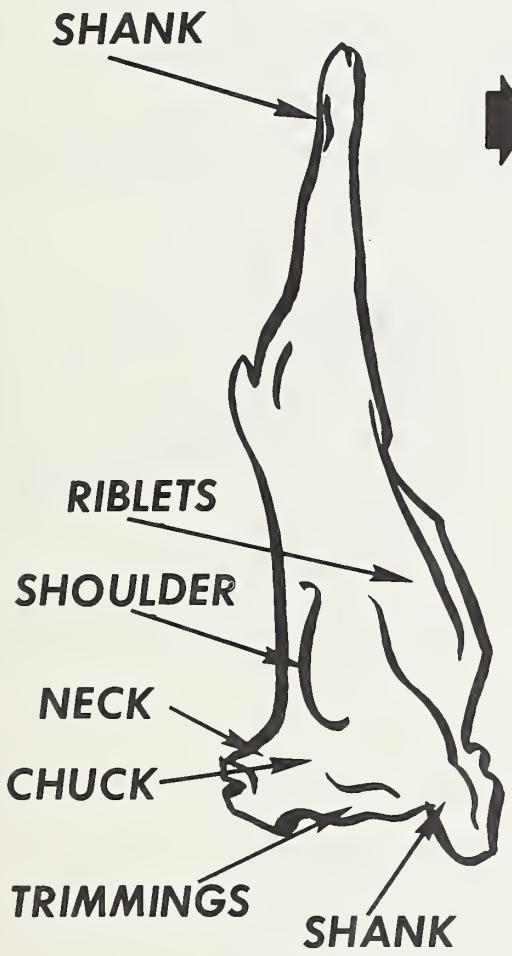

- Continuous water recyle washing of soybean oil reduces pollution
- Reduces oil losses caused by emulsification
- Reduces cost of refining oil
- Removes soap, alkali, metals from oil to produce good-quality product

New Products Improve Lamb Outlook

Department research has developed highly attractive, precooked, frozen convenience items from low demand lamb carcass parts. While demand is high for choice lamb cuts, such as chops and leg roasts, demand for other portions of the lamb carcass is low. Such demands markedly decrease dollar yield from lamb production, with serious effects felt particularly in major sheep producing regions. To offset this disadvantage, lamb curry, shanks, loaf, riblets, sausage, and shish-kabobs have been produced. For example, the lamb curry is a fully prepared and cooked meat dish made from cubes of lamb shoulder, seasoning, fruits, and vegetables packed in frozen form and packaged in a boilable bag. In use, the curry is heated and served over rice, noodles, or on toast. Cost figures indicate that commercial production of these products should be attractive. Consumer evaluation, including that of key personnel of two large purveyors of convenience foods, has been highly favorable. At least one firm is producing and marketing several such products. Opportunities for the new products appear excellent.

# NEW PRECOOKED, FROZEN CONVENIENCE ITEMS DEVELOPED TO INCREASE DOLLAR YIELD FROM LAMB PRODUCTION . . .

- *Recipes use less preferred portions*




*READY TO EAT FROZEN IN BOILABLE BAGS*

*HEAT AND EAT LAMB DISHES*

- *CURRY*
- *SHANKS*
- *RIBLETS*
- *SAUSAGE*
- *LOAVES*
- *SHISH-KABOB*

***CURRENTLY BEING PRODUCED AND MARKETED BY ONE FIRM . . . CONSUMER EVALUATION HIGHLY FAVORABLE***

Collagen Adds a New Dimension to Foods

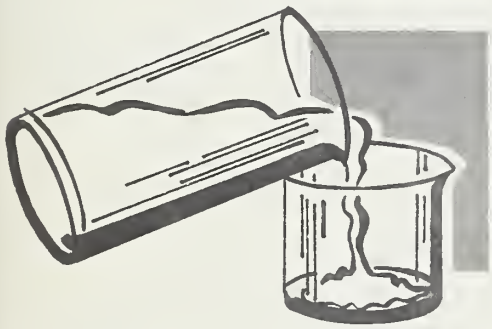
ARS chemists and engineers invented a process for the preparation of an edible, palatable, fibrous product from the flesh splits of cattlehides. This collagen preparation was shown to be 100 percent digestible when fed to rats. While it is not a complete protein, small percentages of collagen can be used with other food for binding, coating, texturizing, and emulsifying. Collagen fibers are readily dispersed under neutral, alkaline, or acid conditions at temperatures below 30° C. ("cold" dispersions) or above 40° C. ("warm" dispersions). The wide range of properties that are available from these types of dispersions enhances the value of collagen. Grits and flours bound with warm neutral collagen dispersions swell in water but do not disintegrate. Soluble proteins and food mixtures with soluble components are made insoluble or slowly soluble by admixture with collagen dispersions. Fats and oils, when emulsified in warm collagen dispersions, form stable emulsions that can be fried or baked to a brown snack. Films, cast from the same dispersion, when dried, withstand boiling in water. Several industrial companies are evaluating this edible collagen for commercial application.

# ARS CHEMISTS and ENGINEERS DEVELOP NEW PROCESS FOR UTILIZATION OF COLLAGEN:

***A FOOD MODIFIER PREPARED BY COMMINUTING HIDE . . .***

- Completely digestible protein
- Neutral color and flavor
- Nontoxic and nonallergenic

***DISPERSIONS FORM STABLE GELS***



HIGH SHEAR WARM DISPERSION
LIQUID

COOLED
SOLID

REHEATED
REMAINS SOLID

**Binds and holds granules, flours, meals during forming, drying, shipping, storage, and cooking**

***SEVERAL INDUSTRIAL COMPANIES CURRENTLY EVALUATING FOR COMMERCIAL APPLICATION***

Untapped Resource for Rural West Virginia

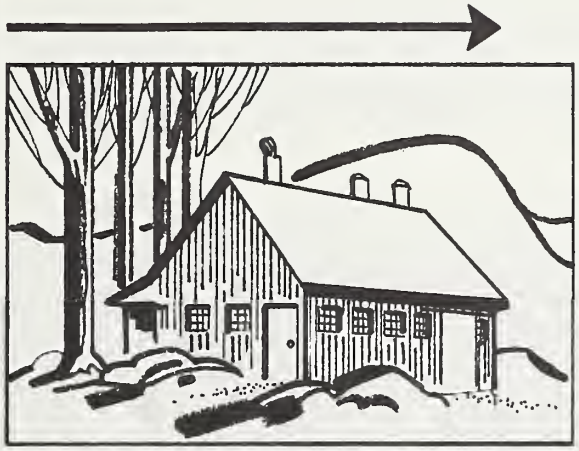
West Virginia has everything needed for a maple syrup industry - except the producers. Although never included in ample syrup production statistics, and having no maple syrup tradition, the State has been found to be well endowed with potential sugar bushes - areas where 80 to 100 taps per acre can be made - by an ARS research contract with the Forestry Department of West Virginia University. This contract is seen as the first step toward establishing a viable maple syrup industry in that State, providing new opportunities for cash income to farmers, landowners, and others.

Such factors as tree density, tree availability for tapping, and local market potential were determined. The density of the stands of sugar maple in West Virginia will permit two types of maple syrup operations. Three possible sites for centralized plants were found (5,000 gallons/year production, 20,000 tapholes within hauling range). Many other areas are well suited for use as an average size sugar bush for individual operation (1,000 to 2,000 taps). For successful operation of a central plant in West Virginia, many trees on public lands would have to be utilized through a lease arrangement. Thus, a maple syrup industry could be established in West Virginia both by establishing a large centralized plant, providing opportunities for "sap farming" with minimal investment, and by having many small individual farm enterprises. The last are traditional throughout the maple syrup industry and would lead to the involvement of many people over a wide area. Recreational development in the State can provide ample retail markets for locally produced syrup. Retail prices recently reached the $10 per gallon range, and since over half of U.S. syrup is imported, there is plenty of room for domestic expansion. With opportunity to begin with modern, low-cost production methods, it is the perfect time to bring modern mapling to West Virginia by a demonstration central maple-syrup evaporator plant.

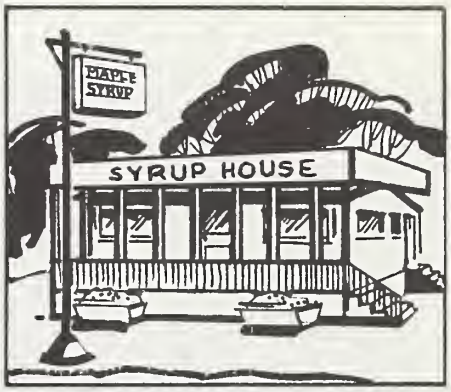
# West Virginia Survey Shares MAPLE SYRUP POTENTIAL

*...ARS research contract with W. Virginia Forestry Department shows promising untapped industrial resource for rural areas*

MAPLE TREE RESOURCE



MODERN EVAPORATOR HOUSE




CONSUMER SALES

- new opportunities for cash income to farmers, landowners, and others
- centralized plant sites found with 5,000 gal./yr. production, 20,000 tapholes within hauling range
- lower U.S. syrup imports

***NEEDS: ESTABLISHMENT OF DEMONSTRATION CENTRALIZED MAPLE-SYRUP EVAPORATOR PLANT***

## Rapid Methods for Detecting Aflatoxins Lead to Safer Foods and Feeds

Rapid, sensitive, inexpensive methods for detecting aflatoxins in affected commodities and in their products are requisite to protecting our food and feed supplies. USDA scientists recently developed two novel rapid methods that are being widely used in several major industries and in research. These methods are known as the fluorescent test, which is applicable to corn, and the minicolumn method, which is applicable to many agricultural commodities and products. The fluorescent test is for preliminary screening to pick out suspect corn samples, while the minicolumn method is for rapid analysis of samples of corn and other commodities to determine whether measurable amounts of aflatoxin actually are present.

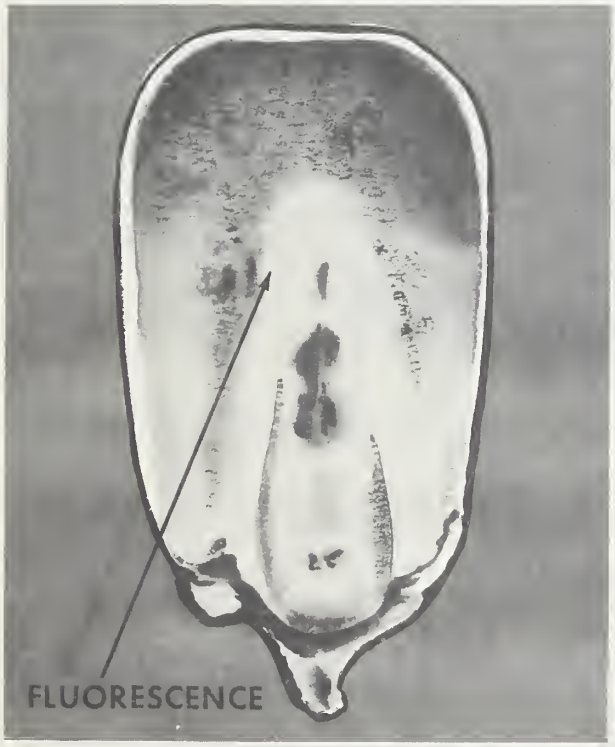
In the fluorescent test, corn is inspected under blacklight or ultraviolet light (365 nm.) with readily available equipment which causes a characteristic bright greenish-yellow fluorescence that is associated with aflatoxins in broken or damaged kernels. If fluorescence is observed, aflatoxin may be present, but not necessarily in appreciable or detectable levels. The greenish-yellow fluorescence is not caused by aflatoxins; rather it is caused by another compound produced by the mold along with aflatoxins. The test, requiring 5 minutes, is being used by small elevator owners, large grain dealers, all corn dry millers, and many wet millers to determine which lots of corn are possibly contaminated and, therefore, need further analysis.

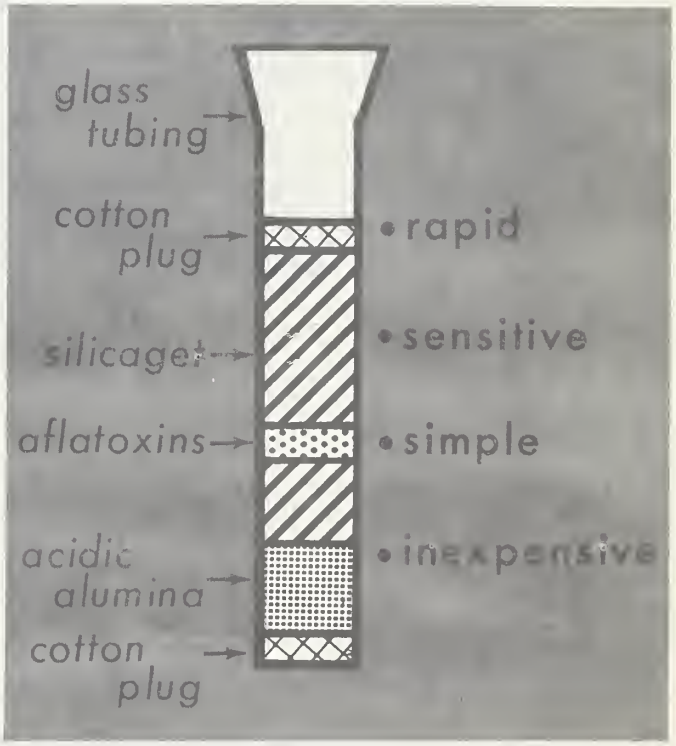
The minicolumn method is a general-purpose method for detecting the presence of aflatoxins in many commodities and products, as well as for confirming whether fluorescing samples of corn actually have aflatoxin contamination. It is named for the small glass column employed for separating the aflatoxins and requires only 15 to 20 minutes to complete, compared with the 3 to 4 hours for standard quantitative methods. After the aflatoxins are separated on the columns, they can be detected as a blue fluorescent band when the columns are exposed to ultraviolet light (365 nm.). This method is being used by the tree nut and corn industries to screen incoming lots of raw materials. Its applicability to other commodities provides a readily available method for other industries that may become involved with aflatoxin-contaminated agricultural commodities.

The simplicity of these rapid procedures and the relatively low cost of analyses have made them acceptable to industry. This has led to their wide use in protecting consumers in the United States and in preventing aflatoxin-contaminated commodities from entering export markets.

# RAPID NEW SCREENING METHODS DEVELOPED FOR DETECTING AFLATOXIN

- Visual inspection under fluorescent light for characteristic green-yellow color in broken or damaged kernels in corn
- Minicolumn screening procedure to detect presence of aflatoxin in levels of 10 p.p.b. or above




***CURRENTLY BEING USED TO PREVENT AFLATOXIN-CONTAMINATED CORN FROM ENTERING MARKET, AND TO PROTECT CONSUMERS***

Recovery of Wheat Gluten

A new process for gluten recovery from wheat decreases water use, eliminates waste effluent, reduces capital requirements for equipment, shortens time in process, cuts down microbial contaminations, and provides 100 percent recovery of solids as useful products. USDA scientists developed the new process as a possible replacement for conventional gluten washing. In the conventional process, about 240 million pounds of second clears flour (a milling byproduct) are used each year. With either the old or the new process, about 30 million pounds of gluten and 150 million pounds of starch are recovered from the 240 million pounds of milling byproduct. In the old operation some 30 to 40 million pounds of flour solids were lost in waste effluents. With the new process these are recovered and can be used for food or feed purposes.

Pilot operations have been successful with the new process in four companies in the U.S., Canada, and Japan. A large milling company is now surveying possible markets for the new protein concentrate (gluten plus soluble protein), obtainable from the process.

Wheat gluten has unique viscoelastic properties that permit entrapment of leavening gases which aid in the formation of desired baked-product structure. Wheat flours are not uniform in their baking quality, and isolated gluten is used to bolster and adjust baking quality.

*USDA develops new wheat protein recovery process*

# WHEAT GLUTEN FROM PROTEIN FRACTION REMEDIES FLOUR VARIABILITY

- uses less water
- shortens processing time
- costs less for equipment
- generates less waste water
- minimizes microbial contamination
- prevents loss of flour solids to wastes (usually 15% of starting material in conventional process)

Efficient New Feed Ingredient Recovered from Alfalfa

A new process, invented by Department scientists and engineers, has reached large commercial scale operations in recovering more value from chopped green alfalfa and producing a new concentrated feed to improve efficiency of meat production. About 4,000 tons of the concentrate, PRO-XAN, was produced each year in 1970 and 1971 from juice squeezed from 300,000 tons of green chopped alfalfa as a byproduct of the production of 65,000 tons of dehydrated alfalfa meal. In contrast to the dehydrated meal, PRO-XAN is a fiber-free product high in protein, vitamins, and pigments. Application of the new process meant the difference between profit and loss to the producers during 1972, a year in which the prolonged dock strike led to reduced exports to Japan and intense competition for domestic markets. The new process will continue to expand in this country. In addition, international interest has been created in seeking purchase of the new product for poultry feed and in using the process for more efficient recovery of leaf protein, including its use for human food in developing countries.

# *ARS develops efficient new process for new feed byproduct from alfalfa*

## PRO-XAN

- Per ton, PRO-XAN fraction is 3 to 5 times more valuable than dehydrated alfalfa meal
- High in protein, vitamins, pigments
- Fiber free

***PRO-XAN HELPS MEET DEMAND FOR BROILER FEED PROTEIN . . . REDUCES PRODUCTION COST OF DEHYDRATED MEAL USED IN LAYING HEN AND CATTLE RATIONS***

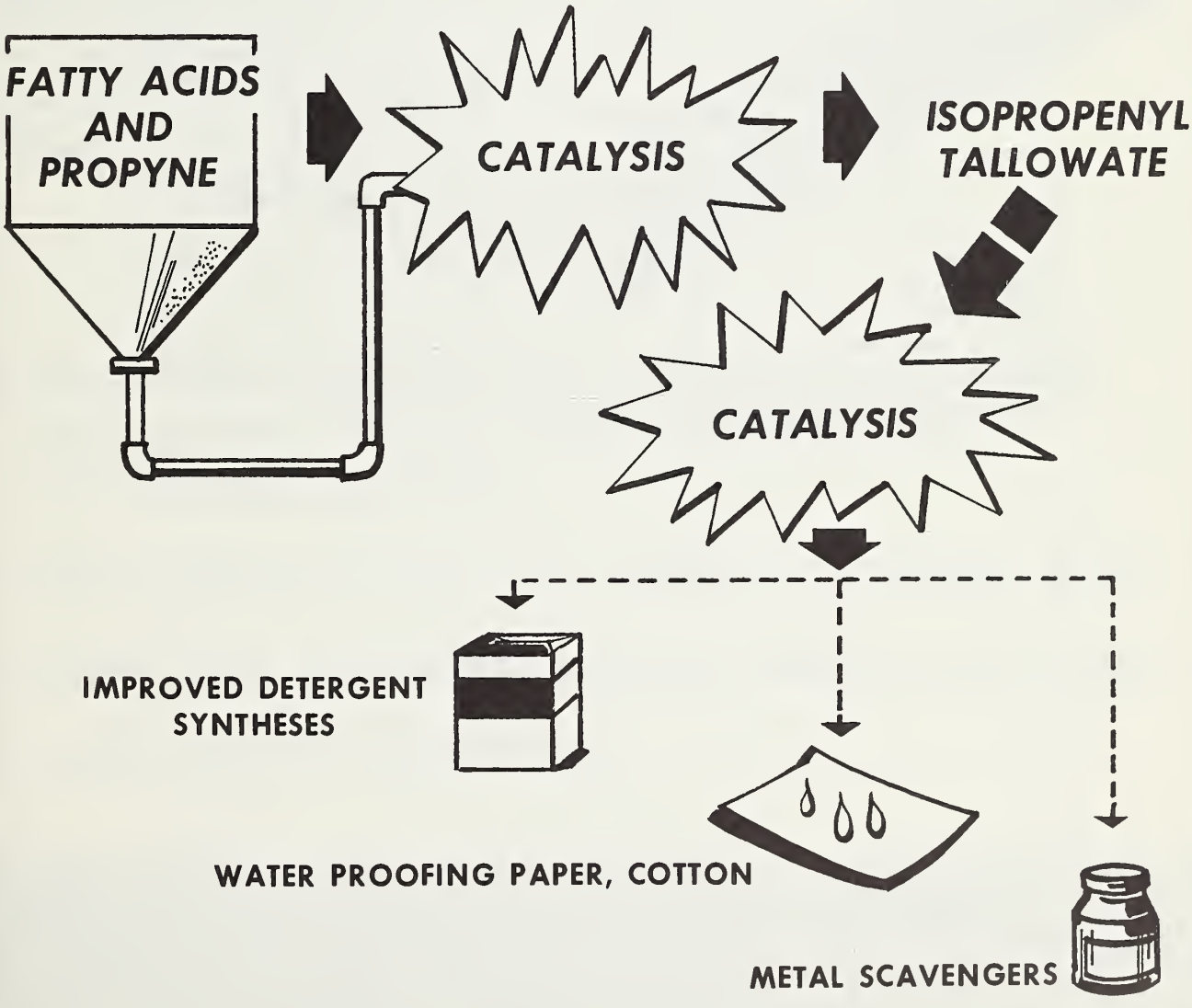
Reactive Chemicals from Inedible Animal Fats

New reactive chemicals, called isopropenyl esters, have been developed that permanently incorporate fatty acids into a wide variety of materials, and thereby adding properties such as lubricity, oil solubility, and water repellency. By means of these special esters, fatty acids may be attached to chemicals at high temperature or to natural products, such as paper, cotton or proteins, at ambient temperature. These esters also provide new and improved methods of synthesizing important chemicals known as lime soap dispersing agents that are used in detergents and special water softeners. In addition, they can be used for synthesizing metal scavenging agents. Isopropenyl esters are readily and inexpensively prepared by a simple chemical reaction, require little purification, and are free of contaminating sulfur or phosphorus. To meet the demand by industry for samples of this versatile chemical, gallon quantities of isopropenyl stearate have been produced in a small pilot plant, and small samples are available for distribution.

*To meet industry demand . . .*

# ARS DEVELOPS NEW REACTIVE CHEMICALS FROM INEDIBLE ANIMAL FATS HAVING GREATER . . .

- lubricity
- oil solubility
- water repellency



## Dialdehyde Starch-Protein Glue Surpasses Conventional Glue for Hardwood Plywood Manufacture

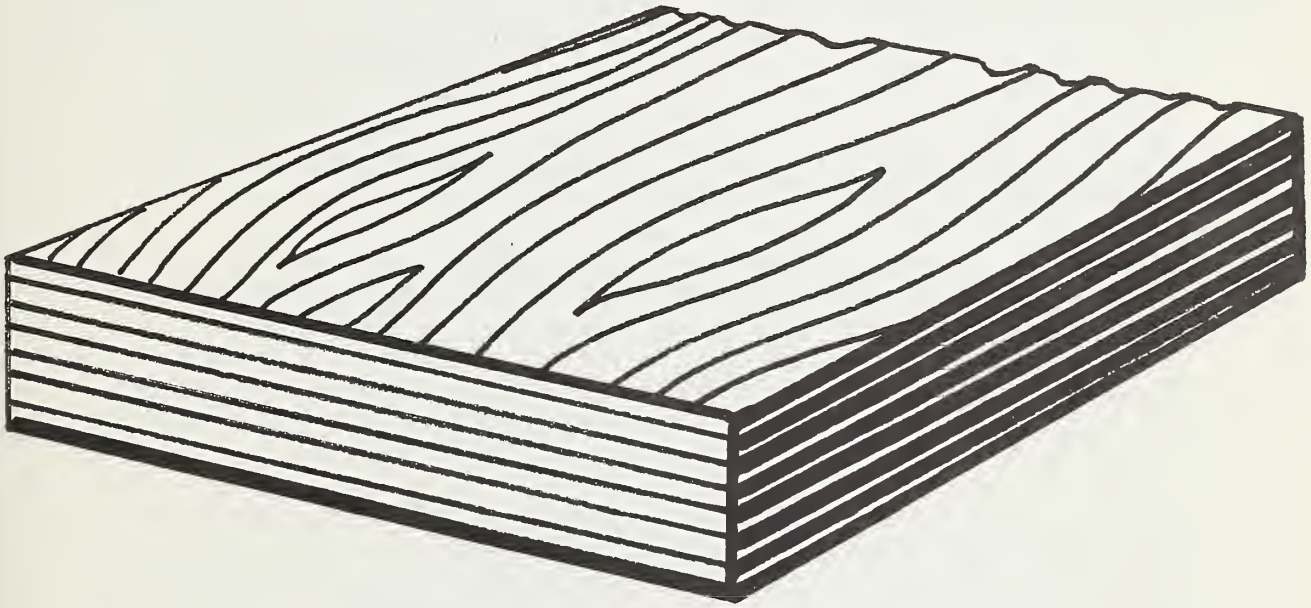
Department scientists have developed a dialdehyde starch-protein (DAS-protein) hot-press glue for the manufacture of interior-type hardwood plywood. Satisfactory plywood has been made in the laboratory with birch, walnut, red and white oak, pecan, and cherry veneers. Recently, 576 birch-plywood panels were produced in a successful mill-scale evaluation of the glue.

The DAS-protein glue exhibited no undesirable characteristics in mill usage. Certain substantial advantages over traditional glues were observed. Mill and machine cleanup was noticeably easier and faster, and cleanliness of personnel was readily maintained because of the ease with which the glue could be washed from hands, gloves, and clothing. Toxic and irritating vapors of formaldehyde released during bonding of veneers with urea-formaldehyde (UF) glue were eliminated. Of greatest significance, however, is the possibility of nearly doubling hardwood-plywood production in a conventional mill through the short cold-prepress and hot-press times achieved with the Department glue.

The new, all-agricultural glue costs about half as much as synthetic UF glue presently used and is similar to it in performance. Application of the glue for the manufacture of only 50 percent of the estimated 1.7 billion square feet of hardwood plywood produced domestically in 1970 would utilize 289,000 pounds of starch as dialdehyde starch and 5.55 million pounds each of soluble dried animal blood and soy flour. A glue cost saving of close to 1.36 million dollars annually could be realized by domestic plywood manufacturers under these circumstances.

# HOT-PRESS DIALDEHYDE STARCH-PROTEIN GLUE

## *. . . Surpasses conventional glue for hardwood plywood manufacture*



- possibility of doubling hardwood-plywood production through short cold-prepress and hot-press times
- glue costs cut to ½ as much as synthetic glue
- plant and personnel cleanup easier and faster
- toxic vapors eliminated

***GLUE COST SAVING OF 1.36 MILLION DOLLARS ANNUALLY BY MANUFACTURERS***

## Quiet Efficient Fan Licensed by Industry to Reduce Noise Pollution

Recent enactment of Public Law 91-596, one provision of which requires manufacturers to control occupational noise, has increased greatly the importance of a quiet industrial fan developed by USDA researchers in connection with their work on textile processing.

Noise from centrifugal fans and blowers creates an acute problem in textile mills and in many other industries. Engineers long ago identified the source of this noise as turbulence at the cutoff, where the flow of rapidly moving air changes from a spiral to a straight line. However, the conventional compromise--reducing the noise by increasing the distance between the cutoff and the blade tips--drastically reduced the fan's capacity and efficiency.

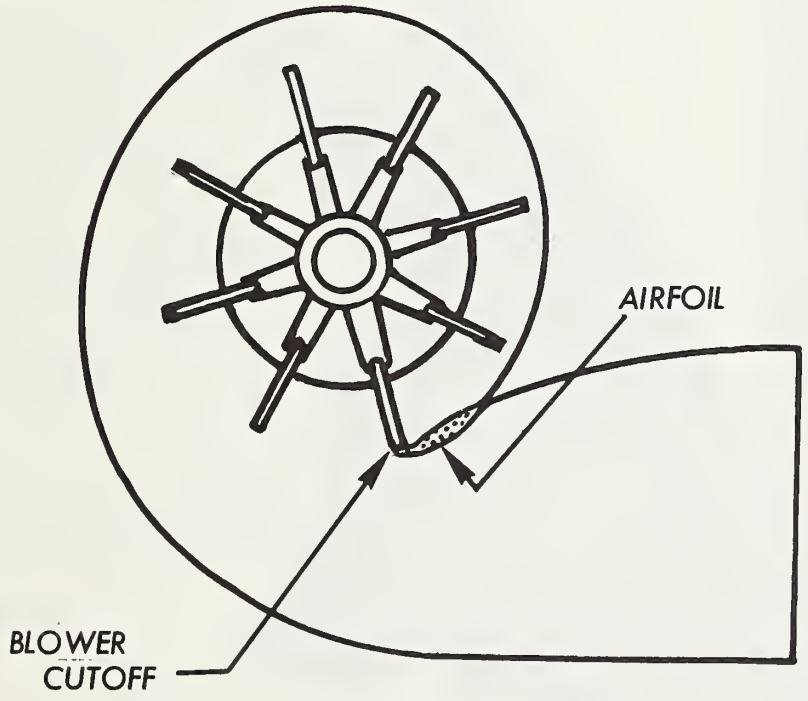
The solution was deceptively simple: to reduce turbulence, Department engineers replaced the standard knife-edged cutoffs with airfoils that have a curved leading edge like an airplane wing. Since these airfoils can be placed very close to the fan blade tips, they not only reduce noise but also increase efficiency. Or, if maximum efficiency is not a determining factor, the distance can be increased slightly to reduce noise still further.

Recognizing the fan's potential contribution toward complying with the new noise-abatement law, two companies are already licensed to manufacture the fan. A machinery journal featured it in a story that began, "Who says that technology can't contribute to improving the environment?"

# QUIET, EFFICIENT AIRFOIL FAN DEVELOPED BY ARS TO COMBAT INDUSTRIAL NOISE POLLUTION

## *SIMPLE MODIFICATION AT BLOWER CUTOFF*

- Reduces turbulence and noise
- Increases worker efficiency




## *TWO COMPANIES CURRENTLY LICENSED TO MANUFACTURE FAN*

New Flame-Retardant Finish for Children's Sleepwear Successful in Mill Trials

Commercial mill trials of the THPOH-ammonia finish--an effective and durable flame-retardant finish for cotton recently developed by Department scientists--have proved eminently successful. This new finish can be applied to fabric of any weight without imparting color or changing the softness and strength of the fabric. It is particularly suited to children's sleepwear fabrics woven of cotton or high levels of cotton blended with synthetic fibers. Sleepwear properly fabricated from such treated fabrics can meet the Department of Commerce's Flammability Standards for Children's Sleepwear (DOC-FF-3-71), which require that by July 29, 1973, all children's sleepwear through size 6X offered for sale must be made flame retardant to meet the standards. USDA, Cotton Incorporated, and a major textile company cooperated in a joint effort to commercialize the process and it is now being produced on a commercial scale. Availability of the fire retardant finished fabrics will help reduce the number of thousands of Americans killed and the quarter million injured each year as a result of burning fabrics.

# SUCCESSFUL COMMERCIALIZATION OF NEW FLAME-RETARDANT FINISH FOR COTTON...

## *particularly suitable for children's sleepwear*

- meets federal flammability standards
- increases consumer protection
- retains softness and strength of fabric
- does not impart undesirable color

## Improved Mineral Dyeing of Outdoor Fabrics Being Evaluated Commercially

As camping and other outdoor activities increase, Department scientists have discovered chemical treatments that provide more durable and attractive cotton fabrics for recreational use.

Conventional mineral dyeing, which is widely used industrially to prolong the life of outdoor fabrics, is a multistep treatment that produces only a pearl-grey tint. Research effort has now led to a new type of mineral dyeing that confers numerous benefits. For the farmer, it retains or increases cotton's place in the growing market for tents, boat covers, and tarpaulins. For the processor, it provides a single-bath system rather than a multistep one. For the consumer, it furnishes colorful fabrics that are durably resistant to weather, mildew, and light.

After successful commercial pilot-plant runs, several mills are evaluating new mineral dyeing processes for yielding various colors, and a manufacturer of chemicals is interested in producing materials for four popular hues--deep blue, bright orange, greenish gold, and olive drab. These companies, Cotton Incorporated, and the Department are cooperating closely to expedite commercialization of this development.

# IMPROVED MINERAL DYEING OF OUTDOOR FABRICS BEING EVALUATED COMMERCIALLY

***ARS EFFORT HAS NOW LED TO A NEW TYPE OF DYEING THAT CONFERS NUMEROUS BENEFITS***

- **weather, mildew, and light-resistant fabrics for tents, tarpaulins, and boat covers ... in popular colors**

## *SUCCESSFUL COMMERCIAL PILOT RUNS EVOKE INDUSTRIAL INTEREST*

Pollution Hazard Yields Energy Source

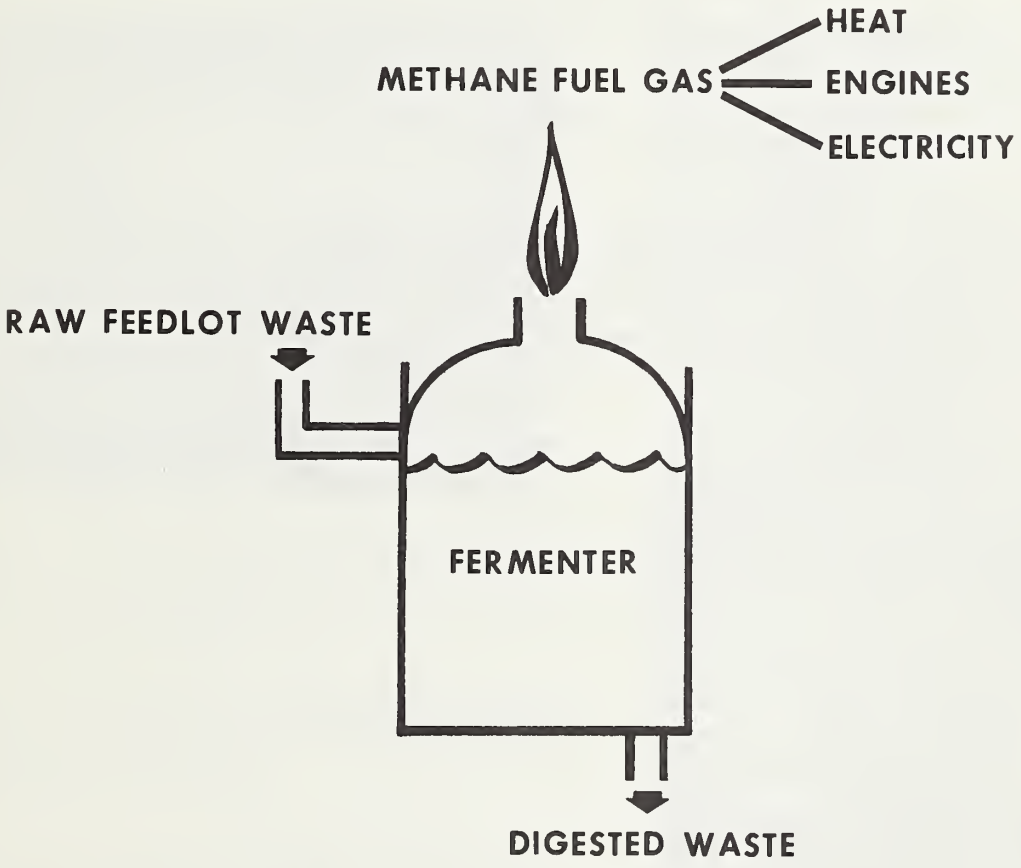
Cattle feeders increasingly utilize feedlots containing thousands of animals in limited space. Such facilities often are located near urban areas or in areas where land for waste disposal is unavailable. In such circumstances, waste accumulates as a pollution hazard that can be alleviated best by utilization rather than by disposal. The utilization process should yield products such as feed and energy, which are usable at the feedlot.

Under USDA contract at Hamilton Standard Division of United Aircraft, a study was conducted on methane fuel gas production by anaerobic fermentation of cattle waste. Certain conclusions were made:

> Anaerobic digestion of cattle waste is feasible: Two 19-liter pilot fermenters operated continuously for more than a year. Up to 1 pound of organic solids can be processed per cubic foot of fermenter volume per day.
>
> The fermentation operates on concentrated waste: At 10 percent solids, anaerobic digestion utilizes waste several-fold more concentrated than is possible in aerobic systems. Major space and power savings occur.
>
> Waste volume is greatly reduced: Half of the waste is consumed by digestion. Since nitrogen is conserved, the protein concentration of digested waste is twice that of raw waste.
>
> A valuable energy source is produced: About 4 cubic feet of methane gas is generated per pound of organic solids introduced. Processing 50 tons of waste or more per day will generate sufficient fuel to operate the system and dry the digested waste.
>
> Anaerobic fermenters operate simply: The fermentation can be monitored adequately by measuring gas production.
>
> The fermentation operates safely: Disease transmission by digested waste is unlikely, because the $50^{\circ}$ C. fermentation temperature will kill most micro-organisms. The enclosed fermenter prevents odor and insect problems.

Application of this fermentation process to cattle waste is sufficiently promising to warrant extending the work. Further study of gas production and nitrogen conversion will be done, followed by evaluation of the digested solids as a feedstuff.

# POTENTIAL UTILIZATION OF FEEDLOT WASTE AS ENERGY SOURCE AND ANIMAL FEED




*METHANE FERMENTATION*

- Concentrated waste - less space
- Low power needed - no air
- Continuous process - simple control

*DIGESTED WASTE*

- 50% reduction of solids
- Double protein content
- Potential animal feed

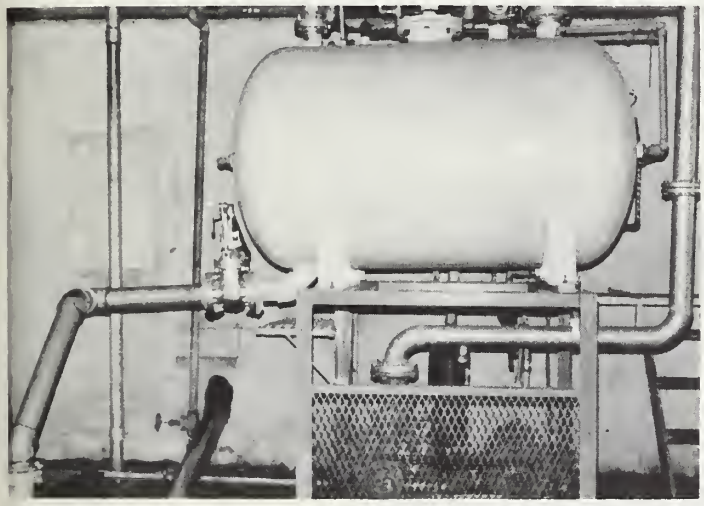
Pollution Abatement in Poultry-Processing Plants

An automated pneumatic blood collection and handling system was developed and commercially tested by ARS scientists. This unit (1) substantially reduces labor requirements for cleaning up the slaughter area in poultry processing plants, (2) greatly reduces the amount of blood that enters the plant effluent (thereby reducing the BOD loading), and (3) provides a cleaner and more wholesome work area within the plant.

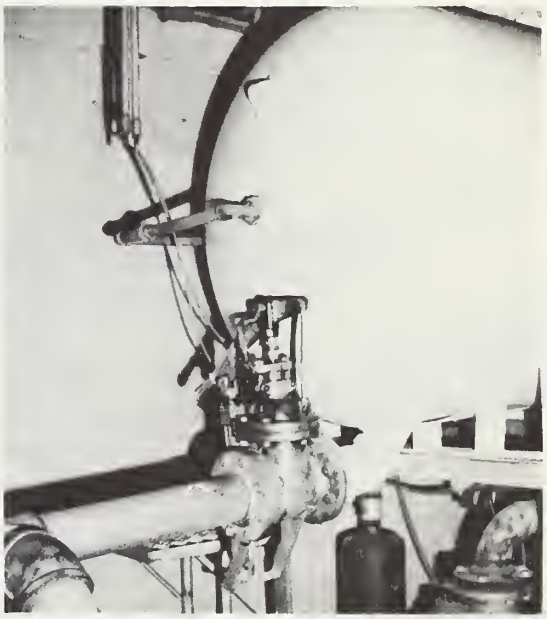
It is estimated that use of the blood collection system by the more than 700 processing plants in the U. S. will save the industry from 2 to 3 million dollars annually through labor savings, pollution abatement, and the revenue received from the sale of collected blood.

This blood system is the first component of an overall waste-handling system that is being developed and tested to handle all wastes from poultry-processing plants. The system is intended to replace the current method of floating waste materials out of the processing areas in a stream of water, with the resulting BOD loading of the effluent with soluble and suspended matter -- the worst pollutants being blood and grease.

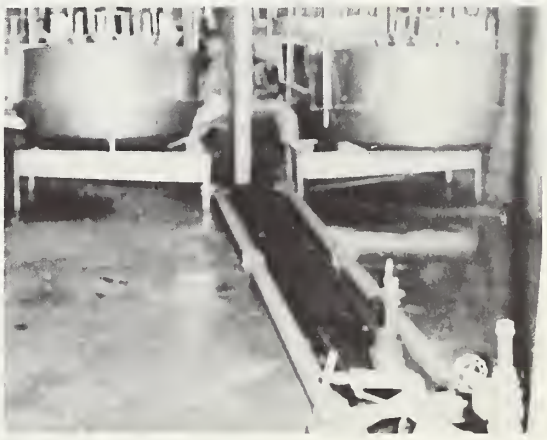
# *Automated pneumatic blood collection and handling system developed for* POLLUTION ABATEMENT IN POULTRY-PROCESSING PLANTS



Above: Side view ot blood collection tank, vacuum pump and controls. System automatically picks up and discharges blood at predetermined intervals.



Above right: An end view of the 500-gallon blood collection tank showing a quick opening valve, for discharging blood, that is operated by an air cylinder.



Below right: View of the blood collection basins under two slaughter lines with no blood on the floor after operating for 8 hours. Prior to installing these catch basins, blood would have been 6 to 8 inches deep on the floor.

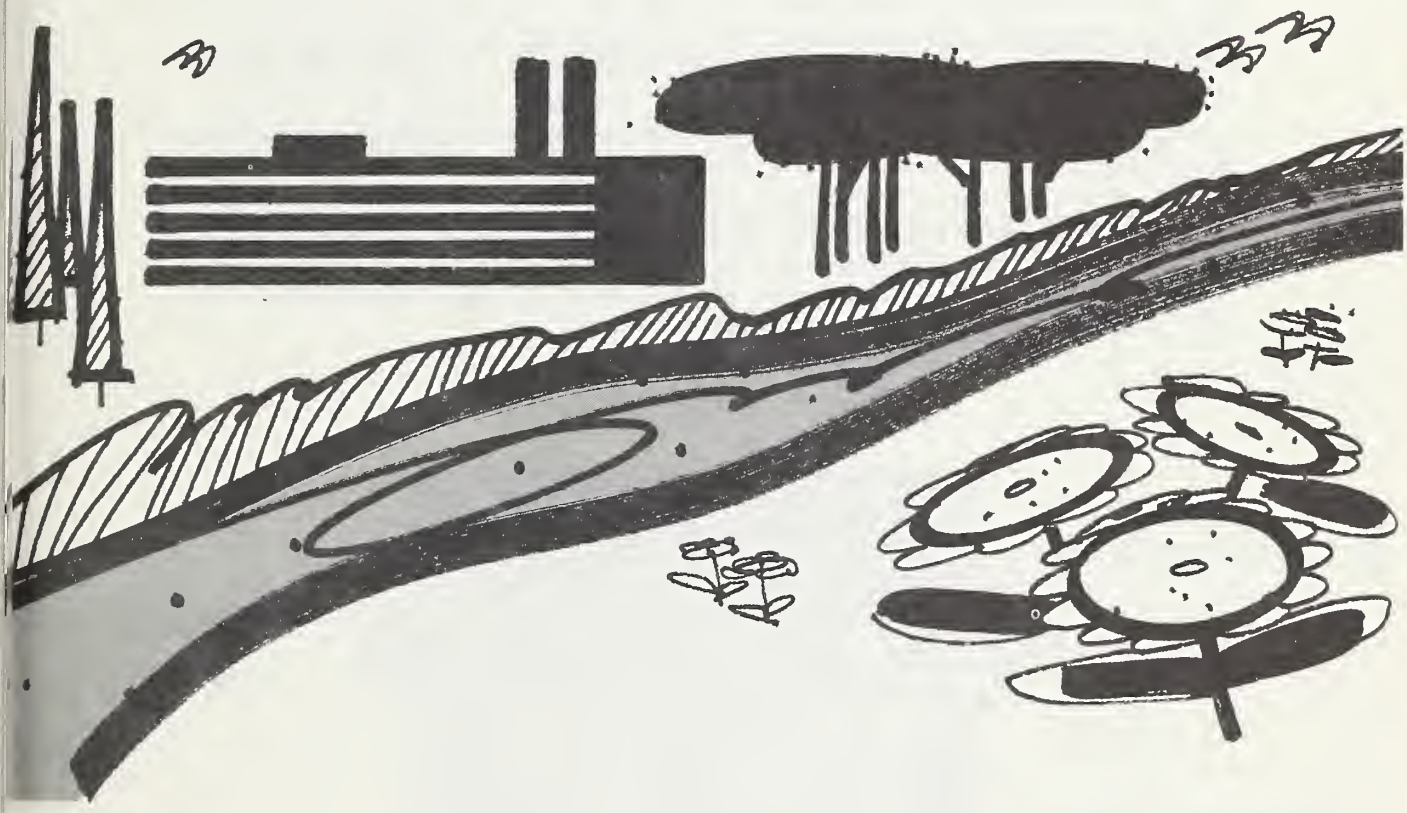
- Reduces labor requirements for cleaning up
- Reduces blood entering plant effluent
- Provides cleaner, more wholesome work area
- Provides savings to industry from 2 to 3 million dollars annually

Reducing Wastes from Wool Scouring

A large U.S. wool processing company has adopted the Department's bentonite process for treating aqueous wool scouring waste liquors to minimize stream pollution problems. The avoidance of stream pollution is essential for survival of the domestic processing industry. Bentonite, a clay material having high absorptive capacity, is added to the scouring liquor from which the recoverable lanolin has been removed. The bentonite absorbs the residue materials that otherwise create a severe stream pollution problem.

*Large U.S. wool processing company adopts USDA's*

# BENTONITE PROCESS FOR REDUCING WASTES FROM WOOL SCOURING



- minimizes stream pollution
- enables processors to meet environmental pollution standards

Membrane Technology Developed for Whey Processing

The application of membrane technology to the problem of whey utilization, as pioneered by ARS research, has been commercialized. Two large plants -- one in the United States and the other in New Zealand -- each capable of processing more than a quarter million pounds of whey per day are in operation. In these plants cellulose acetate membranes are used to concentrate the proteins in whey by ultrafiltration and, in some instances, pure water is removed from whey by reverse osmosis. The principal products manufactured from whey in these plants are (1) whey-protein concentrate, (2) lactose, and (3) a mixture of nonprotein nitrogen, lactose, and milk salts. ARS research has demonstrated that the permeate obtained during ultrafiltration can be spray dried. This finding indicates that ultrafiltration plus spray drying can be used to achieve total recovery of whey solids in unique food mixtures without significant pollution of the environment. The net result of the ARS research, which made important contributions to the use of membrane technology in commercial scale whey processing, will be a reduction in environmental pollution, increased profits for the cheese industry, new nutritious ingredients for the food industry, and a strengthening of a sizable segment of the rural economy.

# WATER POLLUTION REDUCED IN CHEESE MANUFACTURING PLANTS

## *ARS research utilizes* MEMBRANE TECHNOLOGY *for whey processing to achieve:*

- Reduction in water pollution problem
- Increased profits for cheese industry
- Isolation of new nutritious ingredients for food industry


***TWO LARGE PLANTS CURRENTLY PROCESSING MORE THAN 1/4 MILLION LBS. OF WHEY DAILY***

New Efficiency and Waste Reduction in Tomato Processing

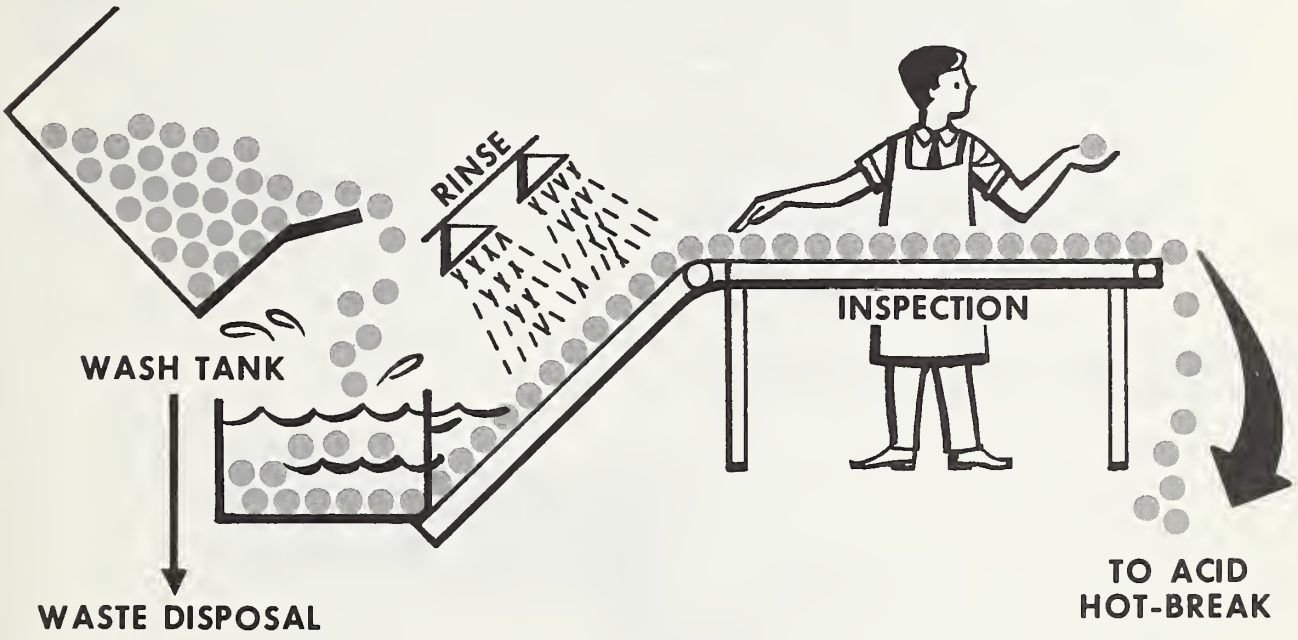
Department scientists developed and are helping to extend to commercial practice a process for tomato concentrates that increases product yield, improves product consistency, and reduces solid and liquid wastes at factory locations. The new acid-break process retains more tomato solids than other processes used and the juice can be concentrated to products with better flow characteristics for catsup, sauce, puree, and other tomato products. The process adds a small amount of common salt (less than in most catsup or sauce formulations) and water (which is removed during subsequent concentration). Fewer fiber skins and seeds accumulate in this new process, and the waste is better suited for dehydration and conversion to animal feed.

The process can be readily adapted to partial processing in field locations, thereby facilitating land disposal of waste waters and of cull fruit in country areas. This field processing will also eliminate the large losses (10 to 20 percent) caused by long hauls of tomatoes from rural areas to urban factories.

The Agricultural Research Service successfully petitioned the Food and Drug Administration in 1971 for an amendment of the Standards of Identity for tomato products, permitting the optional use of the new process. Production and pilot scale trials of the process are being conducted by several large food-processing companies this crop year.

# NEW ACID-BREAK TOMATO PROCESS

## ...benefits processors and consumers...




- Adaptable to partial field processing... allows field disposal of wastes, eliminates hauling losses
- Reduced waste stream loads from plants
- Greater product yield
- Improved consistency

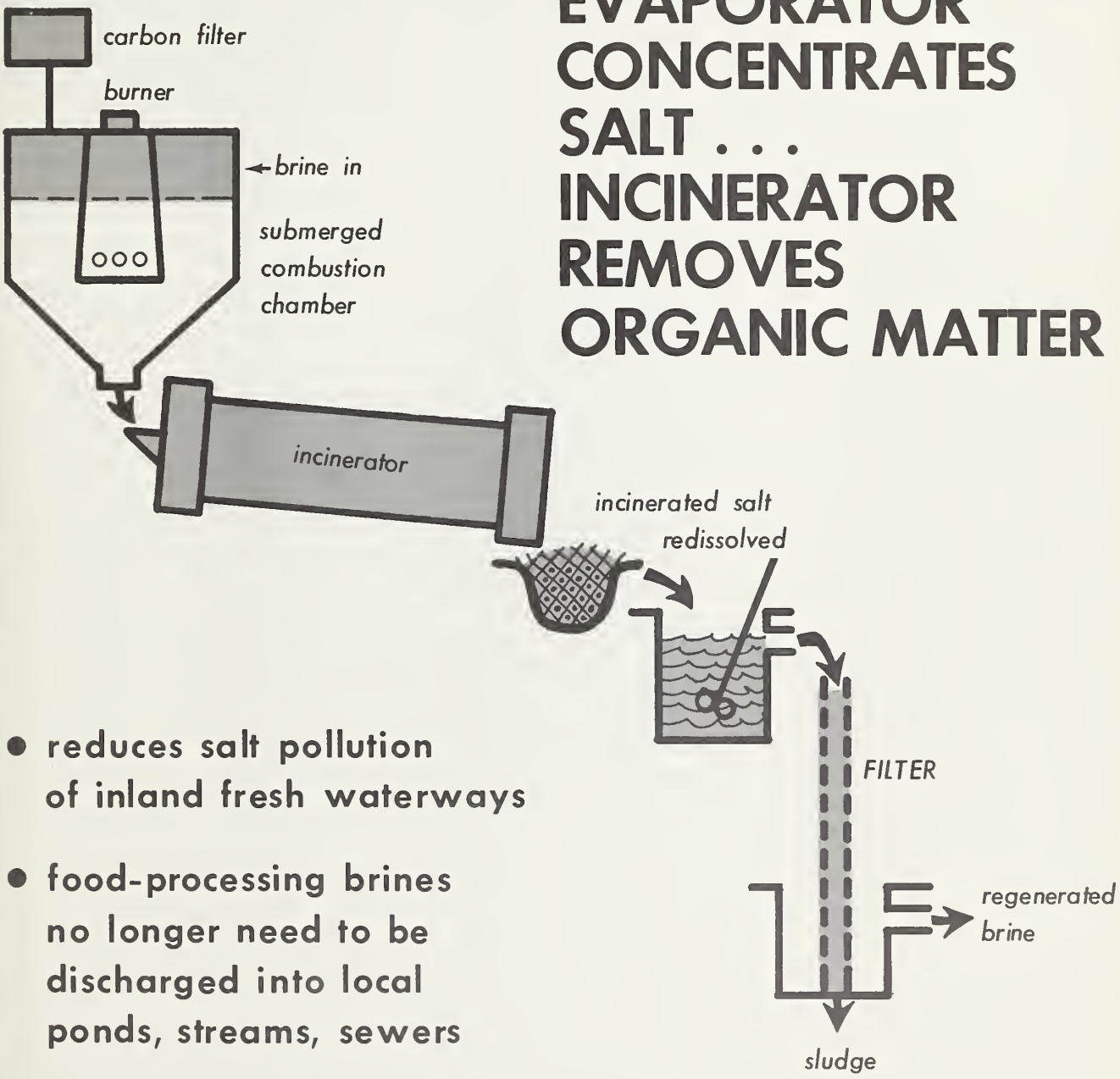
***APPROVED BY FDA...NOW BEING EVALUATED BY TOMATO-CONCENTRATE INDUSTRY***

## Recycling Food-Processing Brines

Salt from food-processing brines can be recycled by a new recovery system. This may save pickle and olive processors now threatened because of the extremely difficult task of disposing of salt-containing liquid wastes. USDA inventors of the submerged combustion-incineration salt reclamation system completed the recovery of a ton of salt from brine used to store last year's cucumbers for pickling at the H. J. Heinz Co. plant in Isleton, Calif. The experimental material was lost in a flood, but a supply will be recovered from another plant in time for further tests this year using the recycled salt to store a commercial batch of cucumbers to test final product quality.

# USDA scientists develop new salt reclamation system for recycling food-processing brines

## EVAPORATOR CONCENTRATES SALT . . . INCINERATOR REMOVES ORGANIC MATTER




- reduces salt pollution of inland fresh waterways
- food-processing brines no longer need to be discharged into local ponds, streams, sewers

## *IN-PLANT TRIALS NOW IN PROGRESS*